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Motives for substance use in the presence and absence of Post Traumatic Stress Disorder (PTSD): A research Portfolio

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Overview

The following research portfolio is comprised of a systematic review entitled 'The association between Post Traumatic Stress Disorder and Substance use Disorder: A Systematic Review' (Chapter 1). Following this review of the wider literature, an empirical research project was carried out to explore motives for substance use in the presence of Post Traumatic Stress Disorder. The portfolio presents a brief rational for the empirical project (Chapter 2) followed by the study aims and hypotheses. Chapter three provides a detailed description of the methods used to conduct the empirical project. The empirical project is reported in the form of a journal article (Chapter 4) entitled 'Motives for substance use in the presence and absence of Post Traumatic Stress Disorder (PTSD)'. This is followed by an extended results and discussion section (Chapter 5). In the final chapters, consideration is given to the strengths and limitations of the study, the clinical implications of the findings, and directions for future research.

Abstract

Background: Post Traumatic Stress Disorder (PTSD) is frequently linked with substance use disorder (SUD). However, the nature of this association remains unclear. A clearer understanding of the dynamic associations between PTSD and SUD may shed light on the course of these two disorders thereby, identifying areas for intervention, which may potentially reduce some of the associated costly and harmful outcomes.

Methods: Firstly, a systematic review was conducted to investigate the evidence base regarding the relationship between PTSD and SUD. Secondly, an empirical project was undertaken to explore functional associations between PTSD and SUD. This was achieved by comparing, motives for substance use, anxiety and depression symptoms, and SUD symptom severity amongst treatment-seeking adults with and without PTSD.

Results: Results from the systematic review suggest that individuals with comorbid PTSD and SUD have more severe clinical profiles compared to individuals with a SUD alone. The results from the empirical study indicate that those with PTSD endorse coping-related motives for substance use significantly more than those without PTSD. Furthermore, those with PTSD had significantly elevated SUD severity ratings and higher anxiety and depression scores.

Conclusions: Findings suggest that individuals with comorbid PTSD and SUD are motivated to use substances to cope with negative affect. The clinical implications of this are discussed.

Chapter 1: Systematic Review

The association between Post Traumatic Stress Disorder and Substance use Disorder: A Systematic Review.

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This review has been written in accordance with Drug & Alcohol Dependence author guidelines (Appendix 1)

The association between Post Traumatic Stress Disorder and Substance use Disorder: A Systematic Review.

Abstract

Background: Substance use disorders (SUD) are highly prevalent amongst individuals with Post Traumatic Stress Disorder (PTSD). High rates of comorbidity suggest that PTSD and SUD are functionally related to one another. However, there is currently a lack of systematic reviews regarding the nature of the relationship between SUD and PTSD.

Objective: The objective of this systematic review is to summarise the literature investigating the association between PTSD and SUD, bearing in mind the methodological rigor of the studies retrieved when considering their findings.

Results 776 articles were identified in the search for relevant articles of which 18 met the inclusion criteria. Relations were found between PTSD, substance use, psychiatric symptoms and depression scores.

Conclusions PTSD and SUD are significantly associated with each other. However, the nature of this association remains unclear. Future research investigating potential mediating variables is required.

Keywords: Post Traumatic Stress Disorder; Substance Use Disorder; Comorbidity.

1. Introduction

It has been well established in both clinical and epidemiological studies that there is a high prevalence of comorbidity between Post Traumatic Stress Disorder (PTSD) and substance use disorder (SUD) (Howard et al., 1998; Jacobsen et al., 2001) (see Chapter 2, section 5 for definitions of PTSD and SUD). Numerous investigations, incorporating a variety of study designs and sample types have documented evidence of this association. In the general population, studies indicate that approximately 3.6 per cent of individuals are affected by PTSD (McCrone et al., 2003). Such studies also indicate that levels of lifetime substance misuse in the general population vary from 8.1 to 24.7 per cent (Shora et al., 2009) and that this increases to between 21.6 and 43 per cent in those with PTSD (Kessler et al., 1995). For individuals in treatment for SUDs, it has been demonstrated that between 30 per cent and 75 per cent meet the diagnostic criteria for lifetime PTSD and 11 to 60 per cent for current PTSD (e.g. Brady, et al., 1994; Jacobsen et al., 2001; Najavits, 2005).

The high prevalence of comorbid PTSD and SUD presents a significant challenge to service providers (Najavits, 2002). For instance, research in this area indicates that patients presenting with PTSD and SUD have poorer treatment prognoses (Ford et al., 2007), higher rates of co-occurring mental health disorders (Schafer and Najavits, 2007), a greater number of medical and interpersonal problems (Back et al., 2009) and a higher use of services (Brown et al., 1995) compared to those presenting with PTSD or SUD only.

It has been suggested that high rates of comorbidity indicate the presence of a functional association between PTSD and SUD (Jacobsen et al., 2001). Several pathways have been described to try and explain the association between PTSD and SUD (for a full review see Stewart, 1996; Stewart and Concord, 2003). The majority of research regarding causal pathways between PTSD and SUD supports the idea that substance use follows or coincides with traumatic exposure and the development of PTSD (Keane and Kaloupek, 1998; Jacobsen et al., 2001). According to this model, substance use is viewed as a means of self-medicating. The 'self-medication' hypothesis (Khantzian, 1997) suggests that individuals use substances in an attempt to reduce distressing psychiatric symptoms (Villagonzalo et al., 2011). Thus, those with PTSD may be motivated to use substances in an attempt to regulate or escape PTSD symptoms of re-experiencing, hyperarousal and avoidance (Tull et al., 2010). In light of such a hypothesis, researchers have investigated variables such as patient's perceptions (Clark and Jacob, 1992) and motives (Dixon et al., 2009) for substance use, order of onset (Mills et al., 2006), severity of substance use and PTSD symptoms (Back et al., 2000), choice of substances used (Jacobsen et al., 2001) and triggers for substance use (Waldrop et al., 2007).

Conclusions from the available evidence regarding the relationship between PTSD and SUD can only be drawn carefully due to methodological limitations (Driessen et al., 2008). For example, there is insufficient information available regarding the association between PTSD and particular substances (Mills et al., 2006). In many studies, diagnoses often remain unclear, for example, alcohol versus drug disorders, substance misuse versus SUD, and suspected versus definite PTSD (Driessen et al., 2008). Additionally, many comorbid studies have focused on individuals exposed to

particular forms of trauma (Stewart, 1996), making it difficult to reach general conclusions about the relationship between trauma exposure, PTSD and SUD across traumatic events. Furthermore, in many studies there tends to be a general lack of use of control groups, particularly in earlier research (Stewart, 1996).

Despite the growing body of literature investigating and substantiating the linkage between PTSD and SUD, there is a lack of systematic reviews regarding the mechanisms underlying this association. Reviews in the area have either not been systematic (e.g. Stewart, 1996) or have had a narrow focus (e.g. Jacobsen et al., 2001). A clearer understanding of the dynamic associations between PTSD and SUD may shed light on the course of these two disorders, thereby identifying areas for intervention (Grottfredson and Wilson, 2003) which may potentially, reduce some of the associated costly and harmful outcomes (Najavits, 2002).

The present review will focus on the methodological quality of studies examining the relationship between PTSD and SUD. Additionally, particular attention will be given to studies that explore factors that perhaps mediate, moderate or better account for the relationship between PTSD and SUD. In short, the primary goal of this review is to systematically summarise the evidence regarding the relationship between PTSD and SUD.

2. Method

Available guidelines for undertaking systematic reviews, such as the ones outlined by the Center for Reviews and Dissemination (CRD), The University of York

(www.york.ac.uk/inst/crd/) and the Scottish Intercollegiate Guidance Network (SIGN) are aimed at evaluating studies focusing on interventions. As such, reporting in this systematic review was based on existing guidance but adapted to suit the review topic.

Studies were identified via a systematic search strategy and then assessed using quality criteria developed from a combination of guidelines provided by the CRD and SIGN (see section 2.4).

2.1 Literature search strategy

Relevant articles for this review were identified using a combination of electronic databases, citation and reference list searches (Petticrew and Roberts, 2006).

Searches were limited to studies published in English because of lack of feasibility for translation of texts. The literature search was initially conducted in October 2011. The Ovid databases (1949-2011), EMBASE (1980-2011) and EBSCO collections (CINAHL Plus with Full Text, MEDLINE with Full Text, PsycINFO, and the Psychology and Behavioural Sciences Collection (1951-2011)) were searched. Searches were conducted within the domains of title, abstract and keywords. Searches were not limited to study design. The following search string was used within each database:

1. [Comorbidity] OR [Relationship] OR [Association] AND
2. [Post Traumatic Stress Disorder] OR [Trauma] AND
3. [Substance use disorder] OR [Substance related disorders] OR [Addiction]

Initial searches also encompassed the following search terms.

4. [Substance relapse] OR [Course of illness] OR [Order of onset] OR [Individual differences] OR [Motives] OR [Expectations]

These later search terms were not mapped and no search limits were imposed during the final searches in order to obtain a comprehensive selection of potential studies for the review. These same databases were then searched again using the same search string in January 2012 to account for any relevant articles published since the duration of the original literature search. The removal of duplicates left a total of 776 potentially relevant papers.

The titles and abstracts of these 776 potentially relevant studies were screened for initial assessment of their suitability according to the predefined inclusion and exclusion criteria, outlined in Table 1. Papers where it could be clearly ascertained from the title and/or abstract that they were irrelevant or did not meet the inclusion criteria were excluded. These were articles that focused on trauma exposure, articles that included a non-treatment seeking population, or articles where the primary aim was to investigate biological factors, other major comorbidities and to develop or test the psychometric properties of an assessment instrument. A full-text review of the remaining 24 papers was then conducted. At this stage, two papers were excluded as

result of the same data set being used in another two studies. In both incidences, the most recent studies were included in the review. Additionally, three studies were excluded that were carried out prior to 2000. This was to allow the review to focus on the most up-to-date literature. This resulted in a total of 12 papers, which met the inclusion criteria. The reference lists of the remaining 12 articles were then searched. This produced a further six papers that satisfied the inclusion criteria. The reference lists of these six papers were also checked, however, no further articles were identified. The final review was based on the remaining 18 studies. The flow of the literature review process is illustrated in Figure 1.

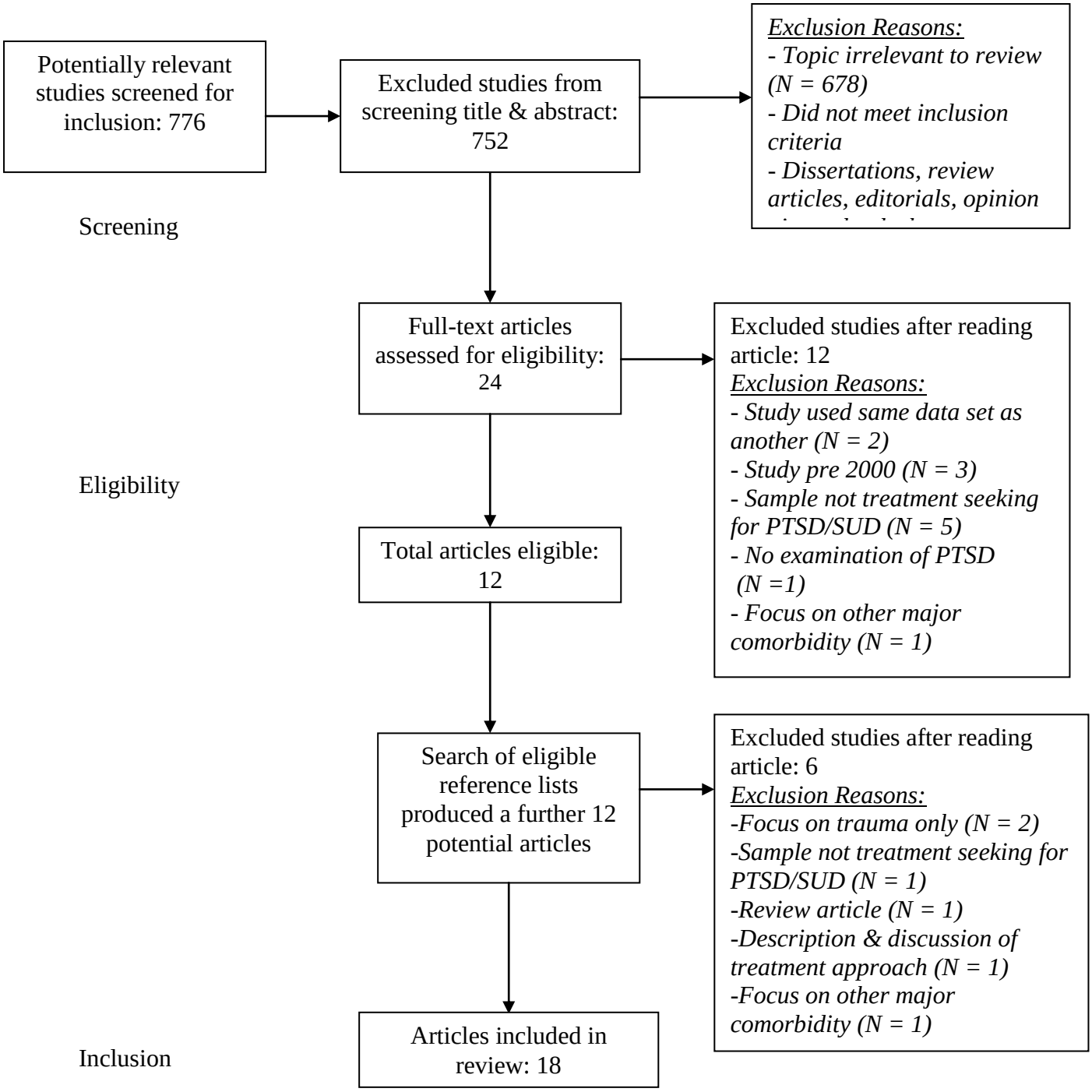

Figure 1. Flow diagram of papers included and excluded at each search stage

2.2 Inclusion and exclusion criteria

All studies that contained information regarding the association between PTSD and SUD were considered for inclusion in the review. In order to develop a comprehensive picture of the relationship between PTSD and SUDs, with the exception of single case studies, review and dissertation studies, all other types of study designs were considered for inclusion. This was considered necessary given the variety of study designs employed within the research investigating the nature of the relationship between PTSD and SUD.

Included studies were based solely on adult participants (within the age range of 18–65 years) with an explicit diagnosis of PTSD (regardless of type of traumatic event) and SUD. The presence of PTSD or SUD was based upon either a structured clinical interview for assessment of a diagnosis according to DSM-IV or ICD-10 criteria, or indicated by validated assessment scales adopting cut-off scores to establish clinically significant symptomatology. In order for findings to be relevant to the target population, studies were excluded if participants were not treatment seeking and/or in treatment for either of the disorders. Only studies focusing on comorbid PTSD and SUD were included with studies focusing on either trauma exposure only and/or other major comorbidities (e.g., psychosis) being excluded.

Table 1 displays the inclusion and exclusion criterion used for the present systematic review.

Table 1 - Inclusion and Exclusion Criteria
Inclusion: 1. Studies that include a comorbid PTSD and SUD population 2. Population must be treatment seeking/in treatment for PTSD and/or SUD 3. Studies published in English and in peer-reviewed journals 4. Participants must be aged between 18 and 65 years of age
Exclusion: 1. Studies only investigative trauma exposure 2. Single case studies 3. The primary aim of the study was to develop or test the psychometric properties of a new assessment instrument 4. The primary aim of the study was to examine biological factors (e.g., MRI, genetics), psychophysiology, or information processing related to PTSD and SUD 5. Studies focusing on other major comorbidities 6. Review articles, book chapters, dissertations, editorials, discussions, and opinion pieces.

2.3 Data Extraction

The key findings and characteristics of the included articles were summarised in relation to the purpose of the current systematic review. A number of the reviewed articles investigated variables and carried out statistical analyses that were irrelevant to the purpose of the current review (CRD, 2009). As such, all papers were reviewed and the information pertinent to the current review objective was extracted. The extracted data is presented in Table 2 (Appendix 2).

2.4 Assessment of quality of included studies

Numerous quality assessment tools exist for systematic appraisal of intervention studies or randomised controlled trials (RCTs). Indeed, between 25 and 60 quality assessment tools are available (Moher at al., 1995; Verhagen et al., 2001). However, quality assessment tools to appraise non-intervention studies are less established (Sanderson et al., 2007). This is possibly the result of the widely held view that RCTs are the 'gold-standard' of research designs (Simon, 2001). Despite this view, the evidence base requires knowledge about the aetiology of mental health problems, which typically stems from observational research (Black, 1996). Given that quality assessment tools permit systematic appraisal and evaluation of research, it appears valid to apply the use of such methods in the evaluation of non-intervention research.

The CRD recommends that quality criteria should encompass an assessment of: the risk of bias; the choice of outcome measure; statistical issues; and quality of reporting. Drawing on these themes and considering the review topic, in order to assess the quality of the studies included in this systematic review, a combination of checklists was employed. In accordance with the available guidance and with consideration given to the review topic, the current review utilised a checklist of 10 quality criteria identified *a priori*, which are outlined in Table 3. The 10 quality criteria were assessed in accordance with six outcome ratings as used by the Scottish Intercollegiate Guidance Network (SIGN) for assessing the methodological quality of research. The author classified each of the 10 quality criteria for each study in terms of one of the following six outcome ratings: 'well covered' (2 points); 'adequately addressed' (1 point); and 'poorly addressed', 'not addressed', 'not reported' and 'not

applicable' (all 0 points). Therefore, each paper was given a rating out of 20, with higher scores indicating superior quality. Papers that met 75 per cent of the methodological criterion specified were considered to be of 'high' quality. Papers that met between 50 per cent and 75 per cent were deemed to have a 'moderate' quality rating and those studies that achieved less than 50 per cent quality rating were considered to be of 'lower' quality. Quality ratings for each of the included studies are summarised in Table 4 (Appendix 3).

Table 3 - Methodological Quality Criteria Checklist:

Quality Criteria	**0 points**	**1 point**	**2 points**
1. Does the study have a clearly focused question? *0 = The aims or hypotheses were not clearly stated* *1 = The aims were clearly stated but not the hypotheses* *2 = The aims and hypotheses were clearly described*			
2. Was the reliability of the diagnoses in question (PTSD/SUD) clearly outlined? *0 = Not explicit or assessed* *1 = parts of standardised interview used to develop own interview/questionnaires alone* *2 = standardised interview/standardised interview plus questionnaires*			
3. What variables were examined that may account for the link between PTSD and SUD? (e.g. individual differences/symptom severity/substance use expectations etc) *0 = not explicit/not relevant/broad range of variables considered* *1 = moderate focus of specific variables* *2 = specific, well documented range of variables considered*			
4. *How were variables that may account for the link between PTSD and SUD assessed?* *0 = self report in an interview only; non-standardised tools; not explicit* *1 = Mixture of self report via interview and standardised self report tools* *2 = only standardised self report tools; measures used are the best available for the author's purpose.*			
5. Are the characteristics of the participants included in the study clearly described? *0 = none/vague* *1= brief/fair description (e.g. demographics/1-2 variables described)* *2 = good description (e.g. treatment length, time since diagnosis, current substance use etc/>2 variables documented)*			

6. Were the inclusion & exclusion criteria clearly defined and did this result in representation of the target population? *0 = Not stated/Sample is very different from the patients seeking treatment for either disorder (e.g. there is unfair exclusion criteria).* *1 = Referred to but not clearly stated/Sample is somewhat representative of patients seeking treatment for this comorbid disorder (e.g. patients were only excluded if they met criteria for other major disorders).* *2 = Clearly stated/Sample is very representative of patients seeking treatment for either disorder (e.g. authors made efforts to ensure representativeness of the sample).*			
7. What was the method of selection of the target population? *0 = Not stated* *1 = Highly selective sample (e.g. consecutive sample from a highly pre-selected group i.e. involved in another study)* *2 = consecutive sample of convenience/ random selection*			
8. Was a power calculation used or sample size justified? *0 = Not completed/under powered* *1 = Issues regarding power or sample size acknowledged/findings or post hoc calculation of power completed but a prior analysis not completed/explained* *2 = A prior sample size calculation completed and the study was sufficiently powered.*			
9. Statistical analysis and presentation of results *0 = Inadequate statistical methods were used and/or data is not fully presented.* *1 = Adequate statistical methods were used but data are not fully presented.* *2 = Adequate statistical methods were used and data is fully presented*			
10. Are the findings presented in light of the available literature/theory? *0 = little or no attempt to link findings to theory* *1 = findings discussed in light of available evidence but no firm conclusions drawn and/or recommendations made* *2 = findings discussed in light of available evidence and firm conclusions drawn and/or recommendations made*			

2.5 Reliability of quality rating

To assess the reliability of this tool, a second reviewer (Z.H) using the same tool rated nine of the final 18 papers. These included papers of high (N = 1), medium (N = 6) and low (N = 2) methodological quality. Overall percentage agreement was high (78 per cent). Discrepancies in ratings were resolved by the author and independent rater meeting to discuss and review disagreements with amendments made where appropriate.

2.6 Data Synthesis

As recommended by the CRD (2009), a narrative synthesis was conducted whilst assessing the quality of papers included in this review. The aim is to provide an objective, robust and clear analysis of the relationship between studies (CRD, 2009).

3. Results

3.1 General overview of papers

The 18 studies included in the review ranged in sample size from 48 to 615 participants. Two studies included male participants only and one study included females only. The majority of the research was conducted in America (N = 13), with two studies carried out in Australia, one in the UK, one in Istanbul and one in Germany. All participants were treatment seeking and/or in treatment for either of the comorbid conditions under investigation. Reporting of participant demographics

varied between studies. In general, the majority of participants had poor educational attainment and were unemployed. Data collection methods included a mixture of standardised self-report measures, structured interview schedules and questionnaires that were adapted and/or developed specifically for the investigation in hand. All of the 18 studies investigated the association between PTSD and SUD.

Most of the included studies discussed their findings in light of the 'self-medication hypothesis' (Khantizan, 1997). Alternative hypothesis were considered in several articles (Back et al., 2006; Hien et al., 2010; Norman et al., 2007; Reynolds et al., 2004; Smith et al., 2010; Villagonzalo et al., 2011). Such as the 'high-risk hypothesis', which suggests that substance use increases the likelihood that individuals will be exposed to traumatic experiences, thereby increasing the risk of developing PTSD (Back et al., 2006). However, results appeared to provide the greatest support for the idea that those with PTSD use substances in an attempt to alleviate the associated distressing symptoms.

The methodological quality of the reviewed papers was variable (see Appendix 3, Table 4). Two studies were of 'high' quality (Driessen et al., 2008; Hien et al., 2010), 13 were 'moderate' (Back et al., 2006; Back et al., 2000; Back et al., 2005; Bornovalova et al., 2009; Clark et al., 2001; Evren et al., 2010; Mills et al., 2006; Norman et al., 2007; Reynolds et al., 2004; Simpson et al., 2006; Smith et al., 2010; Tull et al., 2010; Villagonzalo et al., 2011) and three were of 'low' methodological quality (Ouimette et al., 2007; Read et al., 2004; Waldrop et al., 2007). Studies are reviewed below in order of their quality rating. It was deemed necessary to structure

the review of the included articles in this way given the variety of study designs employed and due to the lack of an identified single comparator between studies.

3.2 High Quality

Hein and colleagues (2010) carried out a RCT with participants being randomised into either a six-week 'trauma-focused group' or a six-week 'health education group'. Participants in both groups were classified at baseline as being abstinent, light substance users or heavy substance users. The temporal course of improvement in symptoms of PTSD and SUD were investigated during the six-week treatment phase of the study and at 1 week, 3 months, 6 months and 12 months follow up. Findings from week-to-week analyses and longitudinal follow up indicated that improvements in PTSD symptoms were associated with subsequent reductions in substance use. There was limited evidence that improvements in SUD were associated with PTSD symptom improvements. Furthermore, trauma-focused treatment was found to be significantly more effective in achieving substance use improvement than the comparison treatment. However, this finding was limited to those classified as heavy substance users at baseline who had achieved significant PTSD reductions. As such, Hein and colleagues suggest that those classified as abstinent at baseline benefited less from a focus on PTSD symptoms as related to substance use behaviours compared to those with active substance use. Several limitations must be taken into consideration when interpreting the results of this study. Firstly, 40 per cent of participants were abstinent at baseline, which restricted the variability in drug and alcohol outcomes. As such, overall treatment effects may have been diluted. Furthermore, the vast majority of participants met criteria for drug abuse or

dependence. Therefore, findings may not be applicable to a primarily alcohol-dependant sample. The sample consisted of females only, which further reduces the generalisability of findings. Additionally, participants were also receiving treatment related to substance abuse, which may have impacted on the outcomes.

Driessen and colleagues (2008) investigated the relationship between PTSD and the severity and course of addiction and psychopathology. This association was explored in patients with PTSD, subsyndromal PTSD (defined as being assessed by one standardised instrument only) and those with a history of trauma exposure without PTSD. This was achieved by comparing individuals with alcohol dependence, drug dependence, or both separately. Higher rates of PTSD were observed in the drug dependent and combined alcohol and drug dependent groups compared with the alcohol dependent group. Compared to all other groups, those with PTSD had higher psychopathology ratings, addiction severity scores, more frequent cravings during the previous month, a greater number of SUD-related hospital admissions, and shorter periods of abstinence from drugs following previous treatments. Furthermore, an earlier onset of alcohol dependence symptoms was found amongst those with PTSD as compared to those with subsyndromal PTSD and the trauma exposed group. In general, PTSD was found to be an independent risk factor of a worse course and outcome of substance dependence. Clearer associations were observed between variables when PTSD was diagnosed with more than one instrument. Given that part of this study investigated the effect of how PTSD is assessed, one limitation relates to the lack of use of a structured interview to diagnose PTSD. Furthermore, the number of statistical tests carried out may have increased the chance of a type one error.

3.3 Moderate Quality

In line with Hein and colleagues (2010), two of the studies rated as having 'moderate' methodological quality (Back et al., 2006; Back et al., 2005) investigated the temporal course of improvement in PTSD and SUD symptoms. Back et al. (2006) found that improvements in PTSD symptoms were associated with improvements in alcohol dependence symptoms and that this association was greater than for the reciprocal relationship. In particular, Back et al. (2006) reported that improvements in hyperarousal PTSD symptoms were related to substantially improved alcohol use. However, Back et al. (2006) also reported that alcohol symptoms tended to start improving either before or in conjunction with PTSD symptoms. Similarly, Back and colleagues (2005) findings suggest that as alcohol consumption decreases so do PTSD symptoms. As such, there appears to be mixed evidence in relation to the temporal course of improvements in PTSD and SUD symptoms. Several explanations may account for such discrepancies. For instance, the Back et al. (2005) study was designed as a medication trial and as such any improvements in symptoms could be attributed to the effects of this. Furthermore, Back et al. (2006) measured alcohol use on a weekly basis and PTSD symptom changes on a monthly basis. This limited the ability to investigate the relationship between order of initial symptom improvement and to therefore make firm conclusions. Due to such methodological limitations inherent in both of these studies, it is difficult to draw firm conclusions with regard to the temporal course of improvement in PTSD and SUD symptoms.

Eight studies reported that individuals with PTSD had higher rates of SUD severity (Back et al., 2000; Back et al., 2005; Bornovalova et al., 2009; Clark et al., 2001;

Reynolds et al., 2004; Smith et al., 2010; Tull et al., 2010; Villagonzalo et al., 2011) compared to those without PTSD. However, only five of these studies found the association between PTSD symptom severity and SUD severity to be statistically significant (Bornovalova et al., 2009; Clark et al., 2001; Smith et al., 2010; Tull et al., 2010; Villagonzalo et al., 2011). Three of these studies focused on specific substances and their relationship to PTSD symptom clusters. Specifically, hyperarousal and avoidance symptoms were found to be significantly associated with heroin use (Tull et al., 2010) and crystal methamphetamine (CM) use (Smith et al., 2010). Re-experiencing and hyperarousal symptoms were significantly associated with cannabis use (Villagonzalo et al., 2011).

Bornovalova et al. (2009) considered the role of emotional regulation whilst examining the relationship between PTSD and SUD symptoms. They found that the association between PTSD symptoms and substance use severity was partially accounted for by difficulties controlling impulsive behaviour when distressed for females and by a lack of emotional awareness and clarity of emotions for males. It is important to highlight that substance use severity was measured by a self-report instrument developed by Bornovalova and colleagues. The investigators failed to report the psychometric properties of this measure. This makes the validity and reliability of the reported substance use severity symptoms questionable.

Five of the thirteen studies rated as having 'moderate' methodological quality included a measure of depressive symptoms (Back et al., 2000; Back et al., 2005; Clark et al., 2001; Mills et al., 2006; Tull et al., 2010). A variety of measures were employed to capture depression (see Appendix 2, Table 2). These include the Beck

Depression Inventory (BDI), the Composite International Diagnostic Interview (CIDI), and the Hamilton Depression Scale (HamD). In general, individuals with PTSD were found to have significantly higher scores on depression measures than those without PTSD (Back et al., 2000; Back et al., 2005; Clark et al., 2001; Mills et al., 2006). For one study this finding was only true for male participants (Back et al., 2005). For investigations that included a follow-up period (Back et al., 2000; Back et al., 2005; Clark et al., 2001; Mills et al., 2006), individuals with PTSD continued to demonstrate significantly higher scores for depression compared to those without PTSD. Additionally, Tull and colleagues (2010) found that severity of depression was significantly associated with PTSD symptom severity.

Five of the studies examined some form of psychopathology in those with PTSD (Back et al., 2000; Clark et al., 2001; Mills et al., 2006; Norman et al., 2007; Reynolds et al., 2004). A broad range of instruments were utilised (see Appendix 2, Table 2), including the Brief Symptom Inventory (BSI); Symptom Checklist-90-Revised (SCL-90-R); and the Composite International Diagnostic Interview (CIDI). In line with Driessen and colleagues (2008), there was a trend for those with PTSD to have higher rates of psychiatric symptoms and disorders as well as poorer psychosocial functioning (Back et al., 2000; Clark et al., 2001; Mills et al., 2006; Norman et al., 2007; Reynolds et al., 2004).

Two of the studies rated as having 'moderate' methodological quality examined alexithymia (Evren et al., 2010; Simpson et al., 2006), which was defined as an "emotional processing deficit" (Simpson et al., 2006). Both studies used the Toronto Alexithymia Scale-20 to measure this variable. Results from these studies were not in

line with each other. Evren and colleagues (2010) found that for male alcohol dependents, alexithymia, particularly difficulty in identifying feelings, predicted PTSD. On the other hand, Simpson and colleagues (2006) found no relationship between alexithymia and PTSD in a largely male alcohol dependent sample. This discrepancy may be due to the differing study designs as well as the variables examined and the associated statistical analysis conducted in both studies. Evren et al. (2010) investigated the relationships between PTSD, alexithymia, temperament and character dimensions and found associations between all of these variables. Simpson et al. (2006) investigated anxiety sensitivity, cognitive avoidance, alexithymia and their relationship with PTSD and alcohol use concurrently and prospectively. They found that anxiety sensitivity accounted for a substantial amount of variance in PTSD symptom severity. Cognitive avoidance accounted for additional variance. They also found no significant relationship between alcohol craving/use and PTSD symptom severity, anxiety sensitivity and alexithymia. Use of alcohol dependant and largely male participants hinders the generalisability of findings from both studies.

3.4 Low Quality

Both Ouimette et al. (2007) and Waldrop et al. (2007) investigated variables associated with relapse in those with PTSD compared to those without PTSD. Ouimette et al. (2007) found that those with PTSD were more likely to report relapse in response to negative emotions than those without PTSD. Similarly, Waldrop et al. (2007) found that those with PTSD reported greater use of cocaine in response to negative situations than those without PTSD. The studies differed in how they

measured relapse characteristics. Ouimette et al. (2007) gathered qualitative data via an adapted version of the 'relapse interview' (Miller and Marlatt, 1996) and Waldrop et al. (2007) gathered quantitative data by employing the Inventory of Drug Taking Situations (IDTS) (Annis and Martin, 1985). Additionally, Ouimette et al. (2007) followed participants up at six months and found that patients with unremitted PTSD reported a more catastrophic view of resuming substance use and lower self-efficacy expectations to cope with high-risk situations in the future than those with remitted PTSD. Ouimette et al. (2007) carried out a large number of statistical tests thus increasing the likelihood of type one errors. It is important to highlight that the data used in Waldrop et al. (2007) study was obtained from two separate studies.

Read and colleagues (2004) investigated PTSD and SUD symptom interplay and the impact of PTSD on SUD outcomes by assessing participants at baseline and at six months follow-up. Findings indicated that those with PTSD had more years of problem substance abuse but did not differ in terms of current level of substance use. Individuals with PTSD were more likely to meet diagnostic criteria for mood and other anxiety disorders compared to those without PTSD. At follow-up, those individuals considered to have unremitted PTSD had worse SUD outcomes than those with remitted PTSD. Furthermore, general psychiatric distress at follow-up was associated with poorer outcomes. Such distress was found to mediate the relationship between PTSD change status and substance use outcomes. This study had a number of methodological limitations, including omission of exclusion and inclusion criteria, minimal description of the sample and no mention of the procedure used. As such, it is difficult to establish the generalisability and indeed reliability of findings.

4. Discussion

This systematic review sought to determine the relationship between PTSD and SUD. Taking all of the studies together, it would appear that individuals with comorbid PTSD and SUD have higher rates of psychiatric disorders; higher scores on depression scales; poorer substance use outcomes; emotional regulation and processing deficits; are more likely to relapse in response to negative emotions and situations; and have negative expectations about being able to cope. It is not clear from the available evidence why those with PTSD have worse clinical profiles than those without PTSD. It is possible that the identified variables, such as depression symptoms and difficulties regulating emotions, contribute toward the observed relationship between PTSD and SUD. Understanding the extent to which such co-occurring variables impact on the association between PTSD and SUD is important as they can be targeted by treatment (Clark et al., 2001).

Overall, the results indicate that PTSD and SUD are positively and significantly associated. Specifically, individuals with PTSD, compared to those without PTSD, tend to have higher rates of SUD symptoms. This relationship suggests that psychological distress associated with exposure to trauma may be a risk factor for the progression of more severe substance use (Clark et al., 2001). Substance use may reduce the negative emotional responses associated with PTSD therefore increasing the likelihood of future substance use (Clark et al., 2001). In line with this suggestion, findings indicate that substance abuse and PTSD symptoms increase simultaneously (e.g. Clark et al., 2001).

Furthermore, there appears to be an association between specific substances and PTSD symptoms. Data from the included studies suggests that individuals with PTSD use heroin (Tull et al., 2010) and CM (Smith et al., 2010) to cope with hyperarousal and avoidance symptoms and cannabis (Villagonzalo et al., 2011) in response to re-experiencing and hyperarousal symptoms. These substances have differing pharmacodynamic properties which makes it difficult to infer that choice of substance is motivated by particular PTSD symptoms. As noted by Villagonzalo et al. (2011), the choice of substance use is influenced by factors other than the pharmacodynamic properties, such as accessibility and costs. As such, individuals with PTSD may be motivated to use substances to ameliorate or escape PTSD symptoms and more broadly, unpleasant emotions (Waldrop et al., 2007) and choice of substance use may be influenced by external factors (Villagonzalo et al., 2011). However, results do not allow casual inferences to be made regarding particular substances and PTSD symptoms.

The relationship between PTSD and SUD is further highlighted by findings that demonstrate improvements in substance use following reductions in PTSD symptoms. However, there are mixed results regarding the temporal course of improvement of symptoms following treatment and methodological issues in a number of the studies that prevent firm conclusions being drawn.

Despite some inconsistencies between studies, results of this review appear to be broadly in line with the 'self-medication hypothesis' (Khantizan, 1997). This theory posits that individuals use substances in an attempt to self-treat psychiatric symptoms. As related to PTSD, the self-medication theory holds that SUDs may develop

following a traumatic event in an attempt to regulate PTSD related negative affect. Although results of this review appear to support this hypothesis, it provides a minimal explanation regarding the causal mechanisms behind it. Studies such as those by Evren et al. (2010) and Simpson et al. (2006) provide a good starting point in the exploration of potential variables that may account for the observed relationship between PTSD and SUD. It would therefore be of interest to explore specifically such individual coping styles and or reasons for using substances.

The findings of this review highlight the many methodological flaws that are inherent within the literature investigating the association between PTSD and SUD. The main methodological flaws included lack of power calculations, as only one study (Reynolds et al., 2004) made any attempt to carry out a power calculation. As such, it is difficult to ascertain whether studies had sufficient sample sizes. This in turn makes interpreting findings problematic. Whilst all of the included studies utilised standardised and validated assessment tools, the tools used varied between studies. Even when the same instrument was employed across studies, how it was used and interpreted differed. This limits the generalisability of findings. Heterogeneity of research designs results in further difficulties whilst interpreting findings. Furthermore, the vast majority of studies included in this review used retrospective data and all of the studies relied on self-reports.

4.1 Limitations

The methodological quality of studies was assessed using a structured rating scale adapted and designed especially for this review. There is a general lack of established

methods, which can be used to assess the quality of non-intervention studies (Sanderson et al., 2007), and no previously published checklist was found to meet the requirements of the review. As such, quality criteria appraisal methods were based on available guidelines and adapted and developed for the purpose of the current review, which may impact on the robustness of results. Whilst quality ratings were also completed by an independent rater (Z.H) and a high level of agreement was reached, there may be limitations in the design of the checklist, which could have introduced bias into the ratings. Furthermore, narrative synthesis is a subjective process (CRD, 2009) and as such is open to reviewer bias.

Results of the current review must be interpreted with caution and take the limitations of the studies reviewed into consideration. Given the variability of research designs, it is difficult to make direct comparison between studies. The poor generalisability of findings between studies must also be held in mind when interpreting results. These issues make it difficult to draw firm conclusions about the relationship between PTSD and SUD.

4.2 Conclusions and implications for future research

The findings of this review highlight the complexity of attempting to understand the relationship between PTSD and SUD. It seems safe to say that there is indeed a strong relationship between PTSD and SUD. However, the reasons for this association remain unclear. Given that individuals with PTSD appear to have more disturbed clinical profiles and have worse treatment outcomes it seems vital for future research to focus on investigating potential causal pathways between these disorders.

Identification of possible variables that mediate the relationship between PTSD and SUD could allow the development of appropriate interventions.

Bearing in mind the methodological limitations inherent in the research in this area, future studies should aim to determine sufficient sample sizes; aim to use prospective data; and perhaps make greater use of longitudinal designs to investigate ways in which substance use is associated with PTSD. If associations between PTSD and SUD are evident after utilising more rigorous methodology this will allow interventions to focus on possible mechanisms identified.

References

Annis, H.M., and Martin, G., 1985. Inventory of drug-taking situations. Addiction Research Foundation of Ontario, Toronto.

Back S.E., Brady, K.T., Sonne, S., and Verduin, M.L., 2006. Symptom improvement in co-occurring PTSD and alcohol dependence. J Nerv Met Dis. 194, 690-696.

Back, S. E., Dansky, B.S., Coffeey, S.F., Saladin, M.E., Sonne, S., and Brady, K.T., 2000. Cocaine dependence with and without posttraumatic stress disorder: a comparison of substance use, trauma history and psychiatric comorbidity. Am J Addict. 9, 51-62.

Back S.E., Jackson, J.L., Sonne, S., and Brady, K.T., 2005. Alcohol dependence and posttraumatic stress disorder: differences in clinical presentation and response to cognitive-behavioural therapy by order of onset. J Subst Abuse Treat. 29, 29-37.

Back, S.E., Waldrop, A.E., and Brady, K.T., 2009. Treatment Challenges Associated with Comorbid Substance Use and Posttraumatic Stress Disorder: Clinicians' Perspectives. Am J Addict, 18, 15-20.

Black, N., 1996. Why we need observational studies to evaluate the effectiveness of health care. BMJ. 312, 1215-1218.

Bornovalova, M.A., Ouimette, P., Crawford, A.V., and Levy, R., 2009. Testing gender effects on the mechanisms explaining the association between post-traumatic stress symptoms and substance use frequency. Addict Behav. 34, 685-692.

Brady, K.T., Killeen, T., Saladin, M.E., Dansky, B.S., and Becker, S., 1994. Comorbid substance abuse and post-traumatic stress disorder: characteristics of women in treatment. Am J Addict. 3, 160-164

Brown, P.J., Recupero, P.R., and Stout, R., 1995. PTSD substance abuse comorbidity and treatment utilization. Addict Behav. 20, 251-254.

Centre for Reviews and Dissemination, 2009. Systematic Reviews: CRD's guidance for undertaking reviews in health care. University of York, York.

Clark, D.B., and Jacob, R.G., 1992. Anxiety disorders and alcoholism in adolescents: A preliminary report. Alcohol Clin Exp Res. 16, p371.

Clark, W.H., Masson, C.L., Delucchi, K.L., Hall, S.M., and Sees, K.L., 2001. Violent traumatic events and drug abuse severity. J Subst Abuse Treat. 20, 121-127.

Dixon, L.J., Leen-Feldner, E.W., Ham, L.S., Feldner, M.T., and Lewis, S.F., 2009. Alcohol use motives among traumatic event-exposed, treatment-seeking adolescents: Associations with posttraumatic stress. Addic Behav. 34, 1065-1068.

Driessen, M., Schulte, S., Luedecke, C., Schaefer, I., Sutmann, F., Ohlmeier, M., Kemper, U., Koesters, G., Chodzinski, C., Schneider, U., Broese, T., Dette, C., and Havemann-Reinicke, U., 2008. Trauma and PTSD in patients with alcohol, drug, or dual dependence: A Multi-Centre Study. Alcohol Clin Exp Res. 32, 482-488.

Evren. C., Dalbudak, E., Cetin, R., Durkaya, M., and Evren, B., 2010. Relationship of alexithymia and temperament and character dimensions with lifetime post-traumatic stress disorder in male alcohol-dependent inpatients. Psychiat Clin Neuros. 64, 111-119.

Ford, J.D., Chapman, J.F., Hawke, J., and Albert, D., 2007. Trauma among youth in the juvenile justice system: critical issues and new directions. National centre for mental health and juvenile justice brief, U.S. Department of Health and Human Services, Washington, DC.

Grottfredson, D. C., and Wilson, D. B., 2003. Characteristics of effective school-based substance abuse prevention. Prev Sci. 4, 27-38.

Hien, D.A., Jiang, H., Campbell, A.N.C., Hu, M., Miele, G.M., Cohen, L.R., Brigham, G.S., Capstick, C., Kulaga, A., Robinson, J., Suarez-Morales, L., and Nunes, E.V., 2010. Do treatment improvements in PTSD severity affect substance outcomes? A secondary analysis from a randomised clinical trial in NIDA's clinical trials network. Am J Psychiatry. 167, 95-101.

Howard, D., Chilcoat, S.D., and Breslau, N., 1998. Post Traumatic Stress Disorders and Drug Disorders. Arch Gen Psychiatry. 55, 913-917.

Jacobsen, L.K., Southwick, S.M., and Kosten, T.R., 2001. Substance use disorders in patients with posttraumatic stress disorder: a review of the literature. Am J Psychiatry. 158, 1184-1190

Keane, T.M., and Kaloupek, D.G., 1998. Comorbid psychiatric disorders in PTSD: Implications for research. In Yehuda, R., and McFarlane, A.C., (Eds), Psychobiology of posttraumatic stress disorder. New York Academy of Sciences, NY.

Khantzian, E.J., 1997. The self-medication hypothesis of substance use disorders: A reconsideration and recent applications. Harvard Rev Psychiat. 4, 231-244.

Kessler, R.C., Sonnega, A., Bromet, E., Hughes, M., and Nelson, CB., 1995. Posttraumatic stress disorder in the National Comorbidity Survey. Arch Gen Psychiatry. 52, 1046-1060.

McCrone, P.R., Knapp, M.R.J., and Cawkill, P., 2003. Posttraumatic stress disorder (PTSD) in the armed forces: health economic considerations. J Traumatic Stress. 16, 519-522.

Miller, W.R., and Marlatt, G.A., 1996. Appendix A: Relapse Interview. Addiction. 91, 231-240.

Mills, K.L., Teesson, M., Ross, J., and Darke, S., 2006. The impact of post-traumatic stress disorder on treatment outcomes for heroin dependence. Addiction. 102, 447-454.

Moher, D.A.R., Jadad, G.N., Penman, N., Tugwell, P., and Walsh, S., 1995. Assessing the Quality of Randomized Controlled Trials: An Annotated Bibliography of Scales and Checklists. Control Clin Trials. 16, 62-73.

Najavits, L.M., 2002. Clinicians' views on treating posttraumatic stress disorder and substance use disorder. J Subst Abuse Treat. 22, 79-85.

Najavits, L.M., 2005. Theoretical perspective on posttraumatic stress disorder and substance use disorder. Aust Psychol. 40, 118-123.

Norman, S., Tate, S.R., Anderson, K.G., and Brown, S.A., 2007. Do trauma history and PTSD symptoms influence addiction relapse context? Drug Alcohol Depen. 90, 89-96.

Ouimette, P., Coolhart, D., Funderburk, J.S., Wade, M., and Brown, P.J., 2007. Precipitants of first substance use in recently abstinent substance use disorder patients with PTSD. Addict Behav. 32, 1719-1727.

Petticrew, M., and Roberts, H., 2006. Systematic Reviews in the Social Sciences: A Practical Guide. Blackwell, Oxford.

Read, J.P., Brown, P.J., and Kahler, C.W., 2004. Substance use and posttraumatic stress disorders: symptom interplay and effects on outcome. Addict Behav. 29, 1665-1672.

Reynolds, M., Mezey, G., Chapman, M., Wheeler, M., Drummond, C., and Baldacchino, A., 2004. Co-morbid post-traumatic stress disorder in a substance misusing clinical population. Drug Alcohol Depen. 77, 251-258.

Sanderson, S., Tatt, I.D., and Higgins, J.P.T., 2007. Tools for assessing quality and susceptibility to bias in observational studies in epidemiology: a systematic review and annotated bibliography. Int J Epidemiol. 36, 666-676.

Schafer, I., and Najavits, L.M., 2007. Clinical challenges in the treatment of patients with posttraumatic stress disorder and substance abuse. Curr Opin Psychiatry. 20, 614-618.

Shora, S., Stone, E., and Fletcher, K., 2009. Substance use disorders and psychological trauma. Psychia Bull. 33, 257-260.

Simon, S.D., 2001. Is the randomized clinical trial the gold standard of research? J Androl. 22. 938-943.

Simpson, T., Jackupack, M., and Luterek, J.A., 2006. Fear and avoidance of internal experiences among patients with substance use disorders and PTSD: The centrality of anxiety sensitivity. J Traumatic Stress. 19, 481-491.

Smith, R.C., Blumenthal, H., Badour, C., and Feldner, M.T., 2010. An investigation of relations between crystal methamphetamine use and posttraumatic stress disorder. Addict Behav. 35, 625-627.

Stewart, S.H., and Concord, P., 2003. Psychosocial models of functional associations between posttraumatic stress disorder and substance use disorder. Trauma and substance abuse: Causes, consequences, and treatment of comorbid disorders. American Psychological Association, Washington, DC.

Stewart, S.H., 1996. Alcohol abuse in individuals exposed to trauma: A critical review. Psychol Bull. 120, 83-112.

Tull, M.T., Gratz, K.L., Aklin, W.M., and Lejuez, C.W., 2010. A preliminary examination of the relationships between posttraumatic stress symptoms and crack/cocaine, heroin, and alcohol dependence. J Anxiety Disord. 24, 55-62.

Verhagen, A.P., de Vet, H.C.W., de Bie, R.A., Boers, M., and van den Brandt, P.A., 2001. The art of quality assessment of RCTs included in systematic reviews. J. Clin. Epidemiol. 54, 651-654.

Villagonzalo, K.A., Dodd, S., Ng, F., Mihaly, S., Langbein, A., and Berk, M., 2011. The relationship between substance use and posttraumatic stress disorder in a methadone maintenance treatment program. Compr Psychiat. 52, 562-566.

Waldrop, A.E., Santa Ana, E.J., Saladin, M.E., McRae, M.L., and Brady, K.T., 2007. Differences in early onset alcohol use and heavy drinking among persons with childhood and adulthood trauma. Am J Addict. 16, 439-442.

Chapter 2: Empirical Project Bridging Section

Motives for substance use in the presence and absence of Post Traumatic Stress Disorder (PTSD)

5. Bridging Section

This section provides a brief outline of the objectives and rationale for the current empirical study.

Firstly, as the focus of this research portfolio is about comorbid PTSD and SUD definitions for both are provided in order to familiarise the reader with these disorders.

PTSD develops in some people following the experience or witnessing of an event that involves actual or threatened serious injury or death or threat to the physical integrity of the self or others (Diagnostic and Statistical Manual of Mental Disorders - fourth ed (DSM-IV); American Psychiatric Association (APA), 2000). Such traumatic events are experienced with fear, helplessness, or horror. The DSM-IV diagnosis of PTSD consists of symptoms in three clusters: 1) re-experiencing symptoms. For instance, intrusive thoughts, flashbacks, nightmares and physiological responses to reminders of the trauma, 2) avoidance symptoms, which involve reduced participation in activities and avoidance of thoughts, people, places, and memories associated with the trauma, and 3) hyperarousal symptoms, which include disturbed sleeping, irritability, difficulty concentrating, hypervigilance and exaggerated startle response.

The DSM-IV classification of a SUD incorporates both substance abuse and dependence. Substance abuse can be defined as the less severe version of the disorder and involves a maladaptive pattern of substance use leading to failure to fulfil work, school, or home obligations, legal problems, and substance-related interpersonal

problems (DSM-IV; APA, 1994). Substance dependence further includes tolerance, withdrawal symptoms upon cessation of use, unsuccessful efforts to control use, and continued use despite persistent substance-related physical or psychological problems.

5.1 Objective

The objective of the current study was to examine motives for heroin and alcohol use in those with PTSD compared to those without PTSD in a treatment-seeking sample of adults.

Alcohol and heroin use were focused on in the current study for several reasons. Firstly, there is a significantly high prevalence of misuse of alcohol and heroin, in comparison to other substances, in the UK and Scotland in particular. For instance, approximately 1.8 per cent of the Scottish population is estimated to misuse opiates (Audit Scotland, 2009). This is almost double the level recorded in England (Audit Scotland, 2009). Additionally, Scotland has the highest rate of injecting drug users with a rate of 5.6 per 1,000 population compared to 4.2 for the UK as a whole (Audit Scotland, 2009). In Scotland, alcohol misuse is even more of a problem than drug use in terms of the number of people misusing and the associated health difficulties (Audit Scotland, 2009). For instance, it is estimated that 4.9 per cent of the Scottish population is alcohol dependent compared with 3.6 per cent in England (Audit Scotland, 2009). Furthermore, existing evidence suggests that opiates are more commonly used by individuals with, than without PTSD (Smith *et al.* 2010). However, there appears to be little research, which has examined the relationship between heroin use and PTSD.

5.2 Rationale

It has been widely documented that there is a high level of comorbidity between Post Traumatic Stress Disorder (PTSD) and substance use disorder (SUD) (e.g. Howard *et al.* 1998). Research indicates that individuals presenting with comorbid PTSD and SUD have worse clinical outcomes (Villagonzalo *et al.* 2011) and a higher use of services (Brown *et al.* 1995) compared to those presenting with either disorder alone. Thus, the high prevalence of co-occurring PTSD and SUD has several important implications in terms of service provision and delivery (Najavits, 2002). Although there is an array of literature substantiating the link between PTSD and substance use there continues to be a lack of knowledge about the mechanisms underlying this association (Dixon *et al.* 2009). Such information is pertinent for the development of appropriate interventions (Grottfredson & Wilson, 2003) and to thereby reduce the high personal and societal costs associated with this comorbidity (Villagonzalo *et al.* 2011).

The available research in this area suggests that high rates of comorbidity indicate the presence of a functional association between PTSD and SUD (Jacobsen *et al.* 2001). Researchers have proposed several causal pathways that may account for the relationship between PTSD and SUD (for a full review see Stewart, 1996; Stewart & Concord, 2003). In one of these pathways, the 'high-risk' hypothesis, substance use is considered to be part of a broad range of 'high-risk' behaviours, for example purchasing illicit substances (Jacobsen *et al.* 2001). According to this hypothesis such behaviours increase the likelihood of being exposed to traumatic events and subsequently developing PTSD (Jacobsen *et al.* 2001).

Alternatively, the 'susceptibility' hypothesis states that individuals who misuse substances are more susceptible to developing PTSD following exposure to a traumatic event (Chilcoat & Breslau, 1998). Several mechanisms have been proposed to explain why individuals who misuse substances might be more susceptible to developing PTSD, including changes in neurochemical systems as the result of extensive substance use (Chilcoat & Breslau, 1998). However, both of these hypotheses have received minimal support in the literature (Villagonzalo *et al.* 2011).

On the other hand, the 'self-medication' hypothesis posits that individuals with PTSD use substances as a means to reduce negative affect (Khantzian, 1997) and emotional numbing, which comprise central diagnostic features of PTSD (APA, 2000; Khantzian, 1997). Thus, the hallmark PTSD symptoms of re-experiencing, hyperarousal and avoidance may all motivate substance use (Kessler *et al*. 2005).

The self-medication hypothesis as it relates to PTSD is well supported in the literature (Chilcoat & Breslau, 1998). For instance, a number of studies have demonstrated that increases in PTSD symptom severity are associated with increases in substance use (e.g. Bornovalova *et al*. 2009; Clark *et al.* 2001; Smith *et al.* 2010; Tull *et al.* 2010; Villagonzalo *et al.* 2011). Conversely, improvements in PTSD symptoms have been found to be related to reductions in substance use (e.g. Hein *et al.* 2010; Back *et al.* 2006). Furthermore, several studies have found associations between particular substances and PTSD symptom clusters. For instance, alcohol disorder symptoms are related to PTSD arousal symptoms (e.g. Stewart *et al.* 1998). Hyperarousal and avoidance symptoms have been associated with heroin use (Tull *et al.* 2010) and crystal methamphetamine (CM) use (Smith *et al.* 2010). Additionally, re-

experiencing and hyperarousal symptoms have been found to be significantly associated with cannabis use (Villagonzalo *et al.* 2011). One possibility for such associations is that substance use is being motivated by particular PTSD symptoms (Smith *et al.* 2010), which would lend support to the self-medication hypothesis.

Following on from this, one factor that may increase understanding about the mechanisms underlying the association between PTSD and SUD is motives for substance use (Bujarski *et al.* 2012). Research investigating the basic underlying motivations for alcohol use suggests that psychological "drinking motives" or reasons for drinking serve as a common pathway to alcohol use and abuse (Cooper, 1994; Cox & Klinger, 1988). In this model other variables, such as psychological distress, influence misuse of alcohol (Stewart & Devine, 2000). Cox and Klinger (1988, 1990) have proposed a categorical model of alcohol use motives. In this model, alcohol consumption is motivated by a desired outcome on one of two dimensions. The first dimension is referred to as "valence" (positive versus negative). For instance, alcohol is used to obtain a positive outcome or to avoid a negative outcome. The second dimension is "source" (internal versus external). This dimension involves drinking to obtain an internal reward or to gain an external reward, such as social approval (Cox & Klinger, 1988, 1990).

These two dimensions yield four distinct categories that relate to drinking motives and have been referred to as enhancement, social, coping and conformity motives (Cooper, 1994). Previous research has clearly established the distinctiveness of each of the four drinking motives in terms of their validity in predicting unique aspects of drinking behavior (see Stewart & Devine, 2000). Cooper (1994) has developed a 20-

item self-report measure (Drinking Motives Questionnaire – Revised, DMQ-R) that captures the frequency of drinking for these four conceptually and empirically distinct reasons. Although Cooper's (1994) measure was designed to examine alcohol use motives and has not been validated for use with individuals who use other addictive substances, it has been employed to measure marijuana use motives (Bujarski *et al.* 2012) and adapted for use with a psychotic population (Spencer *et al.* 2002). Furthermore, there are currently no alternative measures in existence that examine motives for substance use other than alcohol. Additionally, the DMQ-R does not appear to capture motives that are unique to alcohol consumption as compared to alternative addictive substances. Therefore, the current study employed this measure to capture motives for both alcohol and heroin use. From a theoretical perspective, "using substances to cope" is conceptualised as efforts to escape or avoid negative affective states, such as sadness, anxiety, and anger (e.g. Cooper *et al.* 1988). Researchers have suggested that substance use may be used to avoid or reduce the symptoms of post traumatic stress following traumatic event exposure, a strategy that is negatively reinforcing, thereby maintaining substance use (e.g. Kushner *et al.* 2000; Stewart, 1996; Stewart *et al.* 1998).

In support of this perspective, evidence suggests that adults may be motivated to use substances for coping-related reasons. These include using substances to cope with sleep difficulties (Nishith *et al.* 2001), to reduce negative affect (Cannon *et al.* 1992) and in response to the symptoms associated with PTSD (Smith *et al.* 2010; Tull *et al.* 2010; Villagonzalo *et al.* 2011). Additionally, studies investigating perceptions of substance use suggest that patients view substances with arousal dampening properties to be effective in controlling PTSD symptoms (e.g. Bremner *et al.* 1996).

Other studies have found that patients perceive a causal connection between PTSD and substance use (e.g. Clark & Jacob, 1992). Expectations of substance use have also been shown to exert significant influence on substance use behaviour (Schafer & Brown, 1991). In short, expectations and perceptions regarding reduction of PTSD symptoms and enhancement of coping may motivate substance use.

Furthermore, several studies have demonstrated significant relationships between trauma, PTSD, motives for substance use, alcohol and marijuana consumption, depression and anxiety symptoms (Grayson & Nolen-Hoeksema, 2005; Schuck & Widom, 2001; Ullman, *et al.* 2005; Dixon *et al.* 2009; Bujarski *et al.* 2012). Such studies have demonstrated that coping motives in particular mediate the relationship between psychological distress and substance use (Grayson & Nolen-Hoeksema, 2005; Schuck & Widom, 2001) and between PTSD and alcohol problems (Ullman *et al.* 2005). Additionally, PTSD symptoms have been found to be significantly associated with coping-related motives for both alcohol (Dixon *et al.* 2009) and marijuana use (Bujarski *et al.* 2012). These findings appear to lend support to the idea that substance use is aimed at the reduction of PTSD symptoms. As such, motives for substance use appears to be an important factor that can increase understanding about trauma related substance use. However, these relationships have only been demonstrated in community and (Grayson & Nolen-Hoeksema, 2005; Schuck & Widom, 2001; Ullman *et al.* 2005) adolescents samples (Dixon *et al.* 2009; Bujarski *et al.* 2012). The current study, therefore, sought to add to the array of literature investigative the link between PTSD and SUD by comparing motives for substance use in a treatment-seeking sample of adults with and without PTSD.

A clearer understanding of the dynamic associations between PTSD and SUD may shed light on the course of these two disorders, thereby identifying areas for intervention which may potentially, reduce some of the associated costly and harmful outcomes. It is hoped that the present project will not only complement the existing literature regarding comorbid PTSD and SUD but will also shed further light on the functional relationship of the two disorders.

6. Aims and hypotheses

The present empirical project aims to examine functional associations between Post Traumatic Stress Disorder (PTSD) and substance use disorder (SUD). This will be achieved by comparing self-reported motives for substance use amongst adult participants who have a history of either alcohol or heroin related SUD and who do or do not meet diagnostic criteria for PTSD.

Based on the existing empirical and theoretical literature the main research hypotheses are as follows:

1. Participants with PTSD will endorse coping-related motives for substance use significantly more compared to participants without PTSD (one-tailed)

2. The remaining self-reported motives (enhancement, social and conformity) for substance use will be significantly different for those with PTSD compared to those without PTSD (two-tailed)

3. Substance use severity will be significantly greater for those with PTSD compared to those without PTSD (one-tailed)

The secondary hypotheses are:

4. Coping-related motives for substance use will be positively associated with PTSD symptom clusters (one-tailed).

5. Anxiety and depression symptoms, as measured by the Hospital Anxiety and Depression Scale (HADS) (Zigmond & Snaith, 1983), will be significantly higher for those with PTSD compared to those without PTSD (one-tailed)

Chapter 3: Empirical Project Methodology

Motives for substance use in the presence and absence of Post Traumatic Stress Disorder (PTSD)

7. METHODOLOGY

7.1 Design

This study employed quantitative methods to answer the research questions. A between-subjects, cross-sectional questionnaire based design was used to examine differences between participants with and without Post Traumatic Stress Disorder (PTSD) in relation to the following variables: 1) motives for substance use, 2) substance use severity, and 3) anxiety and depression scores. A correlation design was used to examine the relationship between motives for substance use and PTSD symptom clusters.

7.2 Ethical & design considerations

A number of steps were taken to address ethical and design issues during the planning of the study.

7.3 Ethical Approval

The study was reviewed by academic staff at the University of Edinburgh. The research was granted favourable ethical approval by the South East Scotland Research Ethics Committee (Appendix 4). Management approval was obtained from NHS Fife Research and Development Team (Appendix 5) and the University of Edinburgh acted as the sponsor for this study.

7.4 Consent

Consideration was given to the possibility of participants viewing failure to participate in the study as having the potential to impact on any current or future care. This concern was highlighted to the relevant staff members who would be providing information sheets to potential participants. When staff members asked their clients if they wished to participate in the study, it was made explicit that participation was entirely voluntary and that they were under no obligation to take part. It was also made explicit that if they agreed to take part in the study, they could withdraw at any point. The researcher also discussed these points with participants at the initial point of contact. The voluntary nature of the study was also made clear in the Patient Information Sheet (PIS).

7.5 Anxiety and Depression

The possibility of excluding participants without PTSD who had symptoms suggestive of anxiety and/or depression was considered. However, it was decided that this would not be appropriate for the current study given the prevalence of comorbid anxiety and mood disorders among the substance abusing population (Merikangas *et al.* 1998; Grant *et al.* 2004). In turn, the present study aimed to capture a realistic clinical sample of participants accessing Addiction Services. Therefore, inclusion of participants with symptoms of anxiety and/or depression was deemed appropriate. Additionally, excluding participants with anxiety and/or depression could have resulted in a significantly lower amount of usable data. In turn, this would have had the potential to impact on the power of the study, thereby increasing the risk of

making a type two error. The Hospital Anxiety and Depression Scale was selected to capture all of the participant's anxiety and/or depression symptoms. This allows for reporting of potential confounding factors and to control for this in the analysis if necessary.

7.6 Duty of Care

Given the nature of the study, consideration was given to the potential for participants to become distressed whilst responding to the questionnaires. It was decided that the researcher had a responsibility or duty of care to respond to participants who presented as highly distressed. Responses to distressed patients involved:

- The option to either have a break or completely withdraw from the study
- Referral to an appropriate service (in agreement with the participant)
- Provision of self-help materials

This procedure was highlighted prior to participation in the study as well as in the PIS. Additionally, the PIS and consent form stated that if participants indicated the intention to harm themselves (or others) that their GP and other relevant professionals would be informed. Again, this was made explicit by the researcher prior to consent being taken.

7.8 Informing GP's about Participation

The possibility of routinely informing participants GP's about involvement in the study via a standard letter was considered. However, it was decided that this was not appropriate and may have acted as a barrier to participation in the study for many patients. That is, for many of the potential participants, their GP's may not be aware of their involvement with Addiction Services and/or them having a history of trauma.

8. Participants

The sample comprised of two groups of participants. Group one included individuals who met diagnostic criteria for Post Traumatic Stress Disorder (PTSD) and a substance use disorder (SUD). Group two included participants who met diagnostic criteria for a SUD only. Participants were recruited from the various Addiction Services available in the local area. These included, Addictions Clinical Psychology, a community rehabilitation service, a drug and alcohol counselling service, an alcohol counselling service, and a prescribing service (NHS Addictions Service). Participants were included in the study if they had used either alcohol or heroin in the past 12 months and if they were aged between 18 and 65 years. All participants spoke English and met diagnostic criteria for a SUD. Participants were excluded from participation in the study if they had an identified cognitive impairment, learning disability or major psychiatric diagnosis (e.g. bipolar affective disorder or schizophrenia). This was confirmed by checking with the referring professional. Additionally, participants were excluded if they had a history of trauma but did not meet diagnostic criteria for PTSD.

A total of 86 participants indicated interest in taking part in the study, 14 of which did not meet the above inclusion criteria (see Chapter 4, section 14.1).

9. Measures

A copy of all materials used in the current study can be found in Appendix six. Materials included the PIS, consent form, a demographic information sheet, a structured diagnostic interview and nine questionnaires, specifically: The Mini International Neuropsychiatric Interview (MINI), The Trauma History Questionnaire (THQ), the Impact of Events Scale – Revised (IES-R), The Addiction Severity Index (ASI), The Michigan Alcoholism Screening Test (MAST), The Drug Abuse Screening Test - 20 (DAST), The Drinking Motives Questionnaire-Revised (DMQ-R), The Heroin Motives Questionnaire-Revised (HMQR) and the Hospital Anxiety and Depression Scale (HADS). Each of these measures will be discussed in turn.

9.1 Patient Information Sheet (PIS)

A PIS was developed in order to provide details about the purpose and nature of the study, how and where data would be stored, and how it would be used. It was made clear to particpants that current and future service provison would not be affected in any way by choosing to take part or not in the study. It was also highlighted that the study aimed to gather information about particpants who had and had not experienced a history of trauma. Additionally, details were provided of what is meant by this. The risks to particpants were explained and contact details were provided for particpants who had any questions or concerns. Particpants were also informed that

their responses would be anonoymous and that data would be stored in a locked filling cabinet on secure NHS premises.

9.2 Consent Form

A consent form was produced in line with guidance supplied by the South East Scotland Research Ethics Committee and NHS Fife Research and Development department.

9.3 Demographic Information Sheet

A demographic information sheet was designed to collect data regarding gender, age, relationship status, employment status and ethnicity. This was designed in order to collect information regarding the demographic characteristics of the sample.

9.4 The Mini International Neuropsychiatric Interview (MINI) (Sheehan et al. 1998)

The MINI is a short structured diagnostic interview designed for use in clinical and research settings (Sheehan *et al.* 1998). It was developed to assess the diagnoses of 17 psychiatric disorders according to DSM-IV and/or ICD-10 criteria. It is fully structured to allow administartion by non-specialised interviewers (Sheehan *et al.* 1998). In order to keep it short, it focuses on the existence of current disorders. For each disorder, one or two screening questions rule out the diagnosis when answered negatively. The MINI is a brief and patient friendly measure (Vliet & Beurs, 2007). It takes considerably less time to complete in comparison to the alternative diagnostic

interviews (Pinninti *et al.* 2003) such as, the Structured Clinical Interview for DSM-IV disorders (SCID), the Composite International Diagnostic Interview (CIDI) or the Schedules for Clinical Assessment in Neuropsychiatry (SCAN).

The MINI has been validated in the USA and Europe and is available in twenty languages. There have been several studies conducted which investigate the psychometric properties of the MINI (e.g. Sheehan *et al.* 1997, Lecrubier *et al.* 1997). Overall, such studies indicate that the MINI is a reliable and valid instrument in terms of eliciting symptom criteria used in making DSM-IV and ICD-10 diagnoses (Sheehan *et al.* 1998). Furthermore, the positive psychometric properties of the MINI have been said to make it an appropriate choice for research purposes (Vliet & Beurs, 2007).

The PTSD and SUD modules were used for the purpose of the current study to establish the presence or absence of PTSD and SUD. This measure was utilised due to its demonstrated psychometric properties, its efficient administration time and in order to overcome some of the methodological limitations identified in the existing literature. Namely, many studies lack information regarding whether participants meet the criteria for a current diagnoses of PTSD and SUD.

9.5 Trauma History Questionnaire (THQ) (Green, 1996).

The THQ is a 24-item self-report measure that gathers data about a person's lifetime history of exposure to traumatic events in three categories: crime, general disaster and trauma and, sexual/physical assault experiences. The respondent indicates,

whether or not they have ever had the experience (yes/no), and if yes, the number of times and the age of occurrence. For the sexual and physical assault items, participants indicate whether they have had the experience (yes/no), whether it was repeated, and if yes, how often and at what age(s). Additionally, the THQ includes a final item, which allows respondents to report experiences that they considered extremely stressful, regardless of whether these events would be considered traumatic by the investigators. This item can also identify traumatic experiences that are more appropriately recorded elsewhere. In this latter case, the item is re-scored in the appropriate category. Otherwise, the item is not scored. As the THQ is a history-gathering instrument, there is no standard way of scoring or interpreting results (Green, 1996).

The THQ is based on the high magnitude stressor interview from the DSM-IV PTSD field trails (Kilpatrick & Resnick, 1992), and has been used with several clinical and non-clinical samples. It has good test-retest reliability over a two to three month period and produces significant correlations with self-reported distress in college students (Green *et al.* 1996) and with measures of distress and functional status in clinical patients (Green *et al.* 2000). Total and subscale scores have also been found to predict PTSD in cocaine-dependent outpatients (Najavits *et al*. 1998).

The current study employed the THQ for several reasons. Firstly, this measure has been frequently used to investigate trauma prevalence in substance abusing samples. Secondly, to clarify the specific nature of participant's trauma experience, preparatory to a diagnostic interview and symptom checklist for PTSD. Lastly, in order to

minimise confounding variables, the THQ was used to establish a group of substance abusing participants who have no trauma histories.

9.6 The Impact of Event Scale - Revised (IES-R) (Weiss & Marmar, 1996)

The IES-R assesses self-reported PTSD symptomatology experienced in the past seven days, and consists of 22 items measured on a five-point Likert scale (0-4, with labels of 'not at all' to 'extremely'). The revised edition was developed in order to incorporate 7 additional items related to the hyperarousal symptoms of PTSD, which were not included in the original IES. As such the IES-R items correspond directly to 14 of the 17 DSM-IV symptoms of PTSD. The IES-R yields a total score (ranging from 0 to 88) and subscale scores can also be calculated for the re-experiencing (8 items), avoidance (8 items), and hyperarousal (6 items) subscales. The authors recommend using means instead of raw sums for each of these subscales scores to allow comparison with scores from the Symptom Checklist 90 – Revised (SCL-90-R; Derogatis, 1994).

The three symptom subscales of the IES-R have been shown to reliably identify substance dependant individuals with and without PTSD (Rash *et al.* 2008). The IES-R has also been demonstrated to have high internal consistency among the total and subscale scores, as well as excellent reliability and construct validity in a substance abusing sample (Rash *et al.* 2008). In general, the IES-R is not intended as a diagnostic instrument however, it is commonly employed as a screening measure to assess the presence and severity of PTSD symptoms.

The IES-R was selected due to its demonstrated reliability and validity with substance abusing individuals (Rash *et al.* 2008). Additionally, severity of PTSD symptoms can be identified.

9.7 The Addiction Severity Index (ASI) 5th Edition (McLellan et al. 1992)

The ASI is one of the most widely used assessment instruments in the substance abuse field (Alterman *et al.* 1998). It has been used by numerous researchers in studies of treatment outcomes and as a clinical assessment tool in thousands of treatment facilities (McLellan *et al.* 1992). The ASI is a semi-structured interview, which gathers information about the severity of seven potential problem areas (medical status, employment and support, drug and alcohol use, legal status, family/social relationships, and psychiatric problems) commonly affected by drug and alcohol dependence. The ASI gathers information relating to recent (past 30 days) and lifetime problems in each of the seven problem areas. The ASI provides two scores. First, severity ratings which are subjective ratings of the client's need for treatment derived by the interviewer. Secondly, composite scores which are measures of problem severity during the prior 30 days. The ASI has been used with psychiatrically ill, homeless, pregnant, and prisoner populations, but its major use has been with adults seeking treatment for substance abuse problems (Alterman *et al.* 1998).

The inter-rater reliability of the composite scores for the ASI has been reported as excellent (Alterman *et al.* 1998) and high for the interviewer severity ratings (McLellan *et al.* 1985). The internal consistency of the ASI has been reported as being satisfactory (Alterman *et al.* 1998).

The authors of the ASI have indicated that it is acceptable to eliminate entire sections of the interview to meet the needs of a particular research question (McLellan *et al.* 1992). For the present study, only the questions regarding alcohol/drug use status were incorporated to provide a measure of SUD severity. This section asks participant's to rate how important they currently regard treatment for their substance use (0-4, with labels of 'not at all' to 'extremely'), how troubled they have been in the past 30 days by their substance use (0-4, with labels of 'not at all' to 'extremely') and their age of onset of substance use.

The ASI was selected for use in this way in the current study due to the lack of measures that provide an indication of SUD severity. The other sections of the ASI were not deemed to be appropriate or necessary in terms of the research question. Furthermore, the ASI was selected given its extensive use in clinical and research settings and the demonstrated psychometric properties.

9.8 The Michigan Alcoholism Screening Test (MAST) (Selzer, 1971)

The MAST was developed as a quick self-report screening instrument that focuses on alcohol use in the past 12 months and consists of items with a yes/no format. Over the years, several variations of the MAST have been developed, including the brief MAST, the short MAST, as well as the self-administered MAST. The current study utilised the 22-item version of the MAST. Skinner (1979), reports that the total score yielded by the MAST is useful in classifying patients along a continuum according to degree of alcohol misuse. Effectively, the MAST is useful for assessing the severity

of alcohol problems (Saltstone *et al.* 1994). The total score is computed by summing all items that are endorsed in the direction of increased alcohol problems and indicates the problem level associated with alcohol misuse. (e.g. a total score between 6-10 indicates 'intermediate' problem level; 11-15 indicates a 'substantial' problem and scores between 16-22 indicated the presence of a 'severe' problem).

The MAST has been demonstrated as being a valid instrument with substantial correlations between scores on the MAST and scores on other alcohol-use scales having been reported (Ross *et al.* 1990). Furthermore, Zung (1978) reported that the instrument has adequate reliability and validity in its original, abbreviated and self-administered forms. It has been used effectively with both hospitalised and non-hospitalised populations (Zung, 1978) and has been used widely in both clinical and research settings (Gibbs, 1983).

The MAST was selected for use in the present study due to the ability to classify level of severity of alcohol misuse. As such, the MAST provides a further measure of severity of SUD.

9.9 The Drug Abuse Screening Test - 20 (DAST) (Skinner, 1982)

The DAST-20 consists of 20 items with responses taking the form of yes/no. It focuses on drug use within the past 12 months. The DAST yields a quantitative index of the extent of problems related to drug abuse. Thus, it allows the reseracher to record a reliable estimate of the degree of problem severity. The total score is computed by summing all items that are endorsed in the direction of increased drug

problems and indicates the problem level associated with substance use (e.g. a total score between 6-10 indicates 'intermediate' problem level; 11-15 indicates a 'substantial' problem and scores between 16-20 indicated the presence of a 'severe' problem).

The DAST was designed to be used in a variety of settings to provide a quick index of drug-related problems. The 20-item DAST has been demonstarted as having excellent internal consistency and reliability with a drug abusing population (Skinner, 1982). Subsequent research has evaluated the DAST with various populations and in a variety of settings including psychiatric patients (Cocco & Carey, 1998; Maisto *et al.* 2000; Staley & El Guebaly, 1990), prison inmates (Peters *et al.* 2000), substance-abuse patients (Gavin *et al.* 1989), primary care (Maly, 1993), in the workplace (El-Bassel *et al.* 1997), and adapted for use with adolescents (Martino *et al.* 2000). Overall, these studies support the reliability and diagnostic validity of the DAST in diverse contexts.

The DAST-20 was selected for use in the present study due to its ability to classify level of severity of drug use. As such, the DAST-20 provides a further measure of severity of SUD.

9.9.1 The Drinking Motives Questionnaire-Revised (DMQ-R) (Cooper, 1994)

The DMQ-R contains 20 reasons why people might be motivated to drink alcoholic beverages. Participants rate on a 5-point scale how frequently each of the 20 listed reasons motivate them to drink alcoholic beverages. The measure yields four scale

scores reflecting different motives for drinking alcohol - enhancement, social, coping, and conformity motives. The DMQ-R demonstrates good structural and criterion validity, as well as internal consistency, with alphas for each subscale ranging from 0.81 to 0.94 (Maclean & Lecci, 2000).

The current study employed this measure based on the available literature surrounding the reasons for alcohol use. Drinking motives or reasons for drinking have been posited to comprise the "final common pathway to alcohol use" through which other influences on drinking behaviours operate (Cox & Klinger, 1990). The internal, affect-regulation motives, as measured by the DMQ-R have been found to be concurrently associated with riskier alcohol use (Dixon *et al.* 2009). Furthermore, Cooper (1994) stipulates that enhancement and coping motives are both positively related to typical frequency and quantity of alcohol consumption, heavy drinking and alcohol problems. This questionnaire was therefore selected for use in the current study to measure participant's motives for alcohol use. Furthermore, to the author's knowledge, there are no alternative measures that examine motives for alcohol use.

This measure is typically used to investigate lifetime motives for alcohol use. In the present study, the DMQ-R focused on motives for alcohol use in the past 12 months. The purpose of this was to increase the likelihood of capturing a specific time frame for motives of alcohol use and also to align the time frame captured by the other measures employed in the study.

9.9.2 The Heroin Motives Questionnaire-Revised (HMQ-R)

The only available instruments that measure motives for substance use other than alcohol include one that focuses on cannabis use (Bujarski *et al.* 2012) and one that has been adapted for use with a psychotic population (Spencer *et al.* 2002). Both of these instruments are adaptations of the DMQ-R and are not applicable for use in the current study. As such, in order to assess motives for using heroin, the DMQ-R was modified, changing 'alcohol' to 'heroin'. It was decided to use Cooper's (1994) measure in this way to broaden the nature of the current investigation to include those that misuse heroin. This was deemed appropriate given that the DMQ-R captures motives that do not appear to be unique to alcohol compared to other substances of choice. Effectively, the HMQ-R yields the same four subscales as the DMQ-R.

Again, participants were asked to think about their motives for using heroin in the past 12 months.

9.9.3 The Hospital Anxiety and Depression Scale (HADS) (Zigmond & Snaith, 1983).

The HADS is a 14 item self-report questionnaire that consists of seven items for anxiety and seven for depression. The items are scored on a four-point scale ranging from zero (not present) to three (considerable). Response choices vary by item, but higher numbers reflect increasing severity of symptoms. Item scores are added, giving sub-scale scores for anxiety and depression, ranging from zero to 21. Although the HADS was designed for use with hospital General Medical Outpatients, it has been extensively used in Primary Care (Bjelland *et al.* 2002). The

recommended cut-offs for use with adults in primary care settings are eight for both depression and anxiety (Olsson *et al.* 2005).

The concurrent validity of the HADS compared to other questionnaires for anxiety and depression is reported as being between 0.60 and 0.80 for both sub-scales (Bjelland *et al.* 2002). The internal consistency of the HADS has been reported to be good (Bjelland *et al.* 2002). Additionally, the reported severity of symptoms assessed using the HADS and psychiatric ratings have been demonstrated to be significantly correlated (Zigmond & Snaith, 1983). As such, the HADS is considered to be a valid and reliable assessment of mood disorder presence and severity.

In the present study, this measure was incorporated to screen for symptoms of anxiety and depression in all participants. This was decided based on the available literature, which reports a high prevalence of anxiety and depression in the SUD population (e.g. Grant *et al.* 2004; Merikangas *et al.* 1998). Furthermore, PTSD patients typically report higher levels of anxiety and depression than non-PTSD patients (Schafer & Najavits, 2007). Thus, it is important to identify anxiety and depression levels in both the PTSD group and the SUD only group to reduce confounding and to increase the generalisability of results.

10. Procedure

Data used in this study were collected via questionnaires. Additionally, demographic information was recorded by the researcher on a pre-designed data collection sheet. Approval for the study was sought and secured from the South East Scotland

Research Ethics Committee and NHS Fife Research and Development Team. Guidance from the University of Edinburgh was also supplied. The researcher attended the various Addiction Services 'team meetings' to inform staff about the purpose and nature of the project. Staff members from each service were provided with a batch of Patient Information Sheets to disseminate to their clients. Potential participants were given at least a one-week period to consider whether or not they would like to participate in the current study. Clients who indicated that they would like to take part informed their 'worker' and provided verbal consent for their name and telephone number to be passed on to the researcher. Upon receipt of names and telephone numbers, the researcher contacted each potential participant and suitable interview locations and times were arranged. Interviews were conducted in various secure clinic spaces throughout the local area. At the interview, consent was taken after the researcher was satisfied that each participant fully understood that participation was optional and what was involved. After consent was taken the researcher then administered the questionnaires. Participants who had no history of trauma exposure, as indicated by the THQ, were not administered the PTSD measures. Apart from this, all participants were administered the relevant questionnaires. Participants who indicated experiencing multiple traumas were asked to identify, where possible, the trauma that they felt was the most distressing and had the worst impact on them overall. The most traumatic event, again where possible, was then considered whilst completing the IES-R. Data from completed questionnaires were entered into a Statistical Package for Social Science (SPSS) spreadsheet and analysed accordingly. Responses to questionnaires were anonymous such that no participant could be matched to their responses. Consent forms were stored separately from questionnaire responses to ensure anonymity. Both consent

forms and completed questionnaires were stored in a locked cabinet that only the researcher had access to.

11. Power calculation & sample size

Sample size was determined according to the procedures required when between groups analysis is to be applied to data (Clark-Carter, 2010). Unfortunately, no relevant effect sizes are reported in the literature to allow estimation of the effect size for the present study. As such, it was decided to determine the number of participants required to achieve a medium effect size of 0.6 with alpha set at 0.05 (Clark-Carter, 2010). Considering this it was estimated that in order to test the main hypothesis, 35 participants per group would be required to achieve power of 0.80 (Clark-Carter, 2010). Thus, the total estimated sample size required would be 70 participants. A further sample size calculation was carried out using 'GPOWER' version 2, which is a statistical package used to calculate sample size (Erdfelder *et al.* 1996). This calculation, based on the same criteria, indicated that a sample size of 36 participants per group was required for between groups analysis. The upper limit was selected for the current study.

12. Statistical analyses

All analyses were performed using the Statistical Package for Social Science (SPSS) for windows version 18. Prior to beginning analyses, tests of normality of distribution and homogeneity of variance were conducted to evaluate the data against assumptions for parametric tests (Clark-Carter, 2010). The assumptions of parametric

data were tested for those with and without PTSD (regardless of SUD type) and by SUD type (alcohol versus heroin, regardless of PTSD status) (See Chapter 5, extended results). An alpha (*p*) level of 0.05 was used for all analyses.

Histograms, Q-Q plots and, the Kolmogorov-Smirnov test were used to determine if the distribution of scores differed significantly from normality. If the Kolmogorov-Smirnov test (*D*) is significant ($p < 0.05$), data are said to have significantly non-normal distributions. Homogeneity of variance was assessed using Levene's test. If Levene's test is significant ($p < 0.05$), this indicates that the assumption of equal variances has been violated. If this assumption is violated, it can be corrected by reporting the test statistic that does not assume equal variances (Welch's *t*-test).

Parametric tests were selected, as they are more powerful statistics (Clark-Carter, 2010). When the assumptions of parametric tests were violated the non-parametric equivalents were also carried out. This was to establish if the results were in line with the parametric finding and to reduce the likelihood of committing a type one error. Unless otherwise specified, the results of the non-parametric tests were in line with the parametric results.

The sample characteristics were explored to provide additional information about the research sample. Descriptive statistics were presented for the demographic and clinical variables. The data were then examined in relation to the research hypotheses (see Chapter 4):

Hypothesis 1 compared scores on the coping-related motives for substance use subscale for those with and without PTSD. Data were explored through the use of an independent samples t-test (one-tailed).

Hypothesis 2 compared scores on the remaining motives (enhancement, social and conformity) for substance use subscales for those with PTSD and without PTSD. Data were explored through the use of an independent samples t-test for each of these subscales (two-tailed).

Hypothesis 3 compared substance use severity for those with and without PTSD. Data were analysed with use of a chi-square test (one-tailed).

Hypothesis 4 explored the relationship between the coping-related motives subscale and PTSD symptom clusters. This relationship was analysed through the use of Pearson's correlation (one-tailed).

Hypothesis 5 compared anxiety and depression scores for those with and without PTSD. This hypothesis was investigated by use of an independent t-test (one-tailed).

As noted, non-parametric equivalents (e.g. Mann-Whitney U/Spearman's correlation) were also carried out when assumptions of parametric testing were violated.

Additional exploratory analyses were undertaken to examine the relationships between PTSD status, specific substance use (alcohol versus heroin), motives for

substance use, severity of substance use, anxiety and depression scores, PTSD symptom clusters (Chapter 5, extended results).

Effect sizes were calculated for significant findings. For t-tests the following calculation was used, d = Mgroup1 – Mgroup2 / SD pooled (Clark-Carter, 2010). Cohen's (1992) guidance was used to determine the size of significant findings for d (e.g. small = 0.2, medium = 0.5, large = 0.8)

The following calculation was used to determine effect sizes for Mann-Whitney U tests, $r = Z / \sqrt{N}$ (Clark-Carter, 2010; Field, 2005). Again, Cohen's (1992) guidance was used to determine the size of significant findings for r (e.g. small = 0.1, medium 0.3, large = 0.5).

For the chi-square tests the Odds Ratio (OR) was calculated as follows; $n_{11} \times n_{22} / n_{12} \times n_{21}$ (Clark-Carter, 2010).

The internal reliability of the DMQ-R and the HMQ-R measures were assessed using Cronbach's alpha. The internal reliability was assessed by SUD group (alcohol versus heroin) for all participants and separately for the PTSD and no-PTSD groups. Items identified as having a corrected item-total correlation of 0.4 or below and that were significantly reducing Cronbach's alpha were removed. Analyses were conducted with and without the problematic items (see Chapter 5, extended results).

Chapter 4: Journal Article

Motives for substance use in the presence and absence of Post Traumatic Stress Disorder (PTSD)

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This article has been written in accordance with Drug & Alcohol Dependence author guidelines (Appendix 1)

Motives for substance use in the presence and absence of Post Traumatic Stress Disorder (PTSD).

Abstract

Background Post Traumatic Stress Disorder (PTSD) is frequently linked with substance use disorder (SUD). However, the nature of this association remains unclear.

Objective The main objective of the current study was to explore functional associations between PTSD and SUD. This was achieved by comparing motives for substance use, SUD symptom severity, and anxiety and depression symptoms amongst treatment-seeking adults with and without PTSD.

Method This is a between subjects, cross-sectional questionnaire based study.

Results Participants with PTSD endorsed coping-related motives for substance use significantly more, had elevated substance use severity profiles, and higher levels of anxiety and depression, than participants without PTSD

Conclusions Findings lend support to the self-medication hypothesis suggesting that individuals with comorbid PTSD and SUD use substances to cope with negative affect.

Keywords: Post Traumatic Stress Disorder; Substance Use Disorder; Comorbidity; substance use motives.

13. Introduction

It has been widely documented that there is a high level of comorbidity between Post Traumatic Stress Disorder (PTSD) and substance use disorder (SUD) (e.g. Howard et al., 1998; Jacobsen et al., 2001). Research indicates that individuals presenting with comorbid PTSD and SUD have worse clinical outcomes (Villagonzalo et al., 2011), elevated rates of psychiatric symptoms, and a higher use of services (Brown et al., 1995) compared to those presenting with either disorder alone. Thus, the high prevalence of co-occurring PTSD and SUD has several important implications in terms of service provision and delivery (Najavits, 2002). Although there is an array of literature substantiating the link between PTSD and SUD there continues to be a lack of knowledge about the mechanisms underlying this association (Dixon et al., 2009). Such information is pertinent for the development of appropriate interventions (Grottfredson and Wilson, 2003), and to thereby reduce the high personal and societal costs associated with this comorbidity (Villagonzalo et al., 2011).

Several theories have been proposed in an attempt to understand the nature of the relationship between PTSD and SUD (see Chapter 2). Research lends the most support to the idea that substance use may function as a method to reduce psychological distress (Khantizan, 1997). This model, as it relates to PTSD, views substance use as an attempt to cope with distressing post traumatic stress symptoms and has been substantiated by a number of studies (Chilcoat and Breslau, 1998). For instance, evidence suggests that increases in PTSD symptoms often lead to elevated levels of substance use (Villagonzalo et al., 2011). Conversely, improvements in

PTSD symptoms are related to reductions in substance use (Back et al., 2006; Hein et al., 2010).

The examination of what motivates substance use is one promising approach that may increase understanding about the association between PTSD and SUD (Bujarski et al., 2012). Four motives are conceptualized to be involved in substance use behavior (Cooper, 1994). These include coping (e.g. to reduce internal negative affective states), conformity (e.g. to reduce external negative social outcomes), enhancement (e.g. to increase internal positive states), and social motives (e.g. to increase positive external outcomes) (Cooper, 1994).

From the available literature with community and adolescent samples it is apparent that substance use is consistently linked with coping-related motives (e.g. Nishith et al., 2001; Dixon et al., 2009; Bujarski et al., 2012). From a theoretical perspective, "using substances to cope" is conceptualised as efforts to escape or avoid negative affective states, such as sadness, anxiety, and anger (e.g., Cooper et al., 1988). Empirical data demonstrate that substances may be used to cope with core PTSD symptoms (e.g. re-experiencing, avoidance, and hyperarousal) (Smith et al., 2010; Tull et al., 2010; Villagonzalo et al., 2011), general negative affect (Cannon et al., 1992), and sleep difficulties (Nishith et al., 2001)

Such findings appear to lend support to the 'self-medication' hypothesis, suggesting that individuals with PTSD may use substances to cope with negative affect in the context of posttraumatic stress symptoms (Khantizan, 1997). However, there is

limited evidence from adult clinical samples examining motives for substance use in the presence of PTSD.

The current study sought to address this limitation, as well as contribute a novel extension to the existing research, by examining motives for alcohol and heroin use amongst a treatment-seeking sample of adults with and without PTSD. It was hypothesised that participants with PTSD would endorse coping-related motives for substance use significantly more than participants without PTSD. It was also anticipated that there would be significant differences between the PTSD and no-PTSD group for scores on the enhancement, social and conformity motives for substance use subscales. Substance use severity, anxiety and depression scores were also expected to be significantly higher for participants with PTSD compared to those without. Additionally, it was predicted that coping-related motives for substance use would be positively associated with PTSD symptoms (see Chapter 2, section 6 for further details regarding the research aims and hypotheses).

14. Method

A detailed description of the methods used to conduct the present study is presented in Chapter three.

This is a cross-sectional study, which compared a sample of patients with comorbid SUD and PTSD to a sample with SUD without PTSD. The research was approved by the South East of Scotland Research Ethics Committee (Appendix 4) and NHS Fife Research and Development Team (Appendix 5).

14.1 Participants

The total (N = 72) sample comprised of two groups of 36 participants. Group one included individuals who met diagnostic criteria for PTSD and a SUD. Group two included participants who met diagnostic criteria for a SUD only. Participants were recruited from the various Addiction Services available in the local area. These included Addictions Clinical Psychology, a community rehabilitation service, a drug and alcohol counselling service, an alcohol counselling service, and a prescribing service (NHS Addictions Service). Participants were included in the study if they had used either alcohol or heroin in the past 12 months (N = 2 did not meet this inclusion criteria) and if they were aged between 18 and 65 years. All participants spoke English and met diagnostic criteria for a SUD. Participants were excluded from participation in the study if they had an identified cognitive impairment (N = 3), learning disability or major psychiatric diagnosis (e.g. bipolar affective disorder or schizophrenia). This was confirmed by checking with the referring professional. Participants were excluded if they met diagnostic criteria for a SUD relating to a substance other than alcohol or heroin (N = 2). Additionally, participants were excluded if they had a history of trauma but did not meet diagnostic criteria for PTSD (N = 7).

14.2 Measures

The psychometric properties of the measures used in the current study are presented in Chapter three, section nine.

Demographic details were obtained from all participants. Trauma exposure, PTSD, SUD and associated problems, motives for substance use, anxiety and depression scores were assessed using standardised measures and questionnaires as described below:

The Trauma History Questionnaire (THQ; Green, 1996) consists of 24 items addressing a range of trauma events in three areas: 1) crime-related events, 2) general disaster and trauma, and 3) unwanted physical and sexual experiences. Respondents indicate whether they have experienced this event, how many times this has happened, and age of occurrence. For the sexual/physical experiences category, they also identified whether experiences were repeated and how often. The THQ was used to differentiate a group of participants without trauma histories. For those with trauma histories it also served to clarify the specific nature of each participant's trauma experience, and was followed by completing a diagnostic interview and symptom checklist for PTSD.

Participants who indicated experiencing multiple traumas were asked to identify, where possible, the trauma that they felt was the most distressing and had the worst impact on them overall. The most traumatic event, again where possible, was then considered whilst completing the PTSD measures.

The Mini International Neuropsychiatric Interview (MINI; Sheehan et al., 1998) is a short structured diagnostic interview designed for use in clinical and research settings. It assesses the diagnoses of 17 psychiatric disorders according to DSM-IV and/or ICD-10 criteria. The PTSD and SUD modules were used to establish the presence or absence of PTSD and SUD. The PTSD module was only administered to participants who indicated a history of trauma.

The Impact of Event Scale - Revised (IES-R; Weiss and Marmar, 1996) consists of 22 items measured on a five-point Likert scale (0-4, with labels of 'not at all' to 'extremely') and measures PTSD symptomatology experienced in the past seven days. Items are grouped into PTSD symptom clusters as described in the DSM-IV: re-experiencing (8 items), avoidance (8 items), and hyperarousal (6 items). This instrument was utilised to assess the severity of symptom clusters in the PTSD group.

The Michigan Alcoholism Screening Test (MAST; Selzer, 1971) & The Drug Abuse Screening Test - 20 (DAST; Skinner, 1982) measures focus on alcohol and drug use respectively within the past 12 months. Responses take the form of yes/no and yield a quantitative index of the extent of problems related to substance abuse. The total score is computed by summing all items that are endorsed in the direction of increased substance use problems and indicates the problem level associated with substance use. Three problem levels can be identified: 1) 'intermediate'; 2) 'substantial'; and 3) 'severe'. Both measures were selected for use in the current study to provide a measure of substance use severity.

The Addiction Severity Index 5th Edition (ASI; McLellan et al., 1992) is an interview designed to detect and measure the severity of potential problems in seven areas commonly affected by alcohol and drug use. The authors of the ASI have indicated that it is acceptable to eliminate entire sections of the interview to meet the needs of a particular research question (McLellan et al., 1992). For the present study, only the questions regarding alcohol/drug use status were incorporated to provide a measure of SUD severity. This section asks participants to rate how important they currently regard treatment for their substance use, how troubled they have been in the past 30 days by their substance use, and their age of onset of substance use.

The Drinking Motives Questionnaire-Revised (DMQ-R; Cooper, 1994) contains 20 items assessing reasons that might motivate individuals to drink alcoholic beverages. Participants rate on a 5-point Likert scale how frequently each of the 20 listed reasons motivate them to drink alcoholic beverages. The measure yields four scale scores reflecting different motives for drinking alcohol: enhancement, social, coping and conformity motives. In the present study, the DMQ-R focused on motives for alcohol use in the past 12 months. Internal reliabilities for the present sample were good (coping: $\alpha = 0.91$; social: $\alpha = 0.95$; enhancement: $\alpha = 0.72$; conformity: $\alpha = 0.85$) (see Chapter 5 for further information regarding internal reliability analysis).

The Heroin Motives Questionnaire-Revised (HMQ-R). In order to assess motives for using heroin, the DMQ-R was modified, changing 'alcohol' to 'heroin'. It was decided to use Cooper's (1994) measure in this way to broaden the nature of the current investigation to include those that misuse heroin. This was deemed appropriate given that the DMQ-R captures motives that do not appear to be unique to

alcohol compared to other substances of choice. Previous research has similarly adapted the DMQ-R to capture motives for cannabis use (Bujarski et al., 2012) and for use with a psychotic population (Spencer et al., 2002). Effectively, the HMQ-R, yields the same four subscales as the DMQ-R. Internal reliabilities for the present sample were variable (coping: $\alpha = 0.92$; social: $\alpha = 0.84$; enhancement: $\alpha = 0.64$; conformity: $\alpha = 0.64$).

The Hospital Anxiety and Depression Scale (HADS; Zigmond and Snaith, 1983) is a 14 item self-report questionnaire that consists of seven items for anxiety and seven for depression. The items are scored on a four-point scale from zero to three. Response choices vary by item, but higher numbers reflect increasing severity of symptoms. Item scores are added, giving subscale scores for anxiety and depression, ranging from zero to 21. This measure was included to screen for symptoms of anxiety and depression in all participants. This was decided based on the available literature, which reports a high prevalence of anxiety and depression in the SUD population (e.g. Merikangas et al., 1998; Grant et al., 2004). PTSD patients typically report higher levels of anxiety and depression than non-PTSD patients (Schafer and Najavits, 2007). Thus, it is important to identify anxiety and depression levels in both the PTSD group and the SUD only group to reduce confounding and to increase the generalisability of results.

14.3 Procedure

Informed consent was obtained prior to completing any study procedures. Participants were made aware of their right to decline or withdraw consent at any time without explanation and informed that their decision on whether or not to participate in the study would not affect their current or future treatment. Participants who had no history of trauma exposure, as indicated by the THQ, were not administered the PTSD measures. Apart from this, all participants were administered the relevant questionnaires. Interviews were conducted in various secure clinic spaces throughout the local area. Responses to questionnaires were anonymous such that no participant could be matched to their responses. Consent forms were stored separately from questionnaire responses to ensure anonymity. Both consent forms and completed questionnaires were stored in a locked cabinet that only the researcher had access to.

14.4 Power calculation & sample size

An *a priori* power calculation was carried out using 'GPOWER' version 2 (Erdfelder et al., 1996) to inform optimal sample size for the primary research hypothesis. Based on information provided by Cohen (1992), to detect a medium effect size of 0.6 for a t-test (one-tailed) with alpha set at 0.05, 'GPOWER' indicated that 36 participants per group would be required to achieve power of 0.80. As the total sample consisted of 72 participants, adequate power was achieved.

14.5 Data analytic approach

The data were analysed using SPSS for windows version 18. Associations between categorical variables were investigated using the chi-squared test. For scaled variables, t-test analysis was used. Associations between motives for substance use and PTSD symptoms were assessed with correlational analysis. When data violated the assumptions of parametric tests (see Chapter 5, extended results for tests of parametric assumptions), both parametric and non-parametric equivalents were carried out and results compared. Unless otherwise specified, the results of the parametric tests were in line with the non-parametric results. Effect sizes are reported for significant findings.

15. Results

15.1 Demographic & descriptive data

The data were collected from 72 participants; 46 (63.9 per cent) were male and 26 were female (36.1 per cent). The mean age of the total sample was 37.2 (SD 11.8). The mean age of the male participants was 39.8 (SD 10.3), and the mean age of the females was 32.5 (SD 13.3). 70 (97.2 per cent) participants were Caucasian and 2 (2.8 per cent) were of Indian, black or other ethnic minority. 39 (54.2 per cent) participants were single, 25 (34.7 per cent) were married, cohabiting or in a long-term relationship, and 8 (11.1 per cent) were divorced. 54 (75 per cent) participants were unemployed, 8 (11.1 per cent) had full or part-time employment, and 10 (13.9 per cent) were in a training or educational programme. 35 (48.6 per cent) participants had no children, 23 (31.9 per cent) had children living at home or adult children not living

at home, and 14 (19.4 per cent) had children who were looked after and accommodated.

37 (51.4 per cent) participants met diagnostic criteria for an alcohol related SUD and 35 (48.6 per cent) met criteria for a heroin related SUD. 36 (50 per cent) met diagnostic criteria for Post Traumatic Stress Disorder (PTSD). 30 (83.3 per cent) of the 36 in the PTSD group reported experiencing four or more traumatic events, 2 (5.6 per cent) reported three, and 4 (11.1 per cent) reported one. Of those participants with PTSD, 19 (58.2 per cent) had an alcohol related SUD, and 17 (41.8 per cent) had a heroin related SUD. There was a significant association between PTSD status and employment status (X^2 (4) = 11.8, p = 0.019, N = 72). Participants with PTSD were approximately 8 (Odds Ration (OR) = 7.85) times more likely to be unemployed compared to participants without PTSD. There were no significant differences between the groups for any other demographic variables.

Table 5 includes descriptive data for participants with and without PTSD with regard to the following variables; 1) motives for substance use subscale scores as measured by the DMQ-R/HMQ-R, 2) HADS anxiety and depression scores, 3) substance use age of onset, and 4) hyperarousal, re-experiencing and avoidance scores as measured by the IES-R.

Table 5. Summary of descriptive data for clinical variables

	PTSD (*N* = 36) *M* (SD)	No-PTSD (*N* = 36) *M* (SD)
DMQ-R/HMQ-R		
Coping	22.05 (3.19)	12.64 (3.68)
Enhancement	11.03 (3.97)	12.0 (2.28)
Social	8.5 (4.81)	13.08 (4.6)
Conformity	6.92 (3.6)	7.72 (2.08)
HADS		
Anxiety	17.31 (4.27)	9.89 (3.86)
Depression	14.06 (5.85)	9.72 (3.43)
Age of onset	14.86 (3.97)	19.28 (4.15)
IES-R		
Hyperarousal	19.61 (4.76)	-
Re-experiencing	25.68 (6.22)	-
Avoidance	24.28 (4.76)	-
Total	69.47 (19.51)	-

(DMQ-R = Drinking Motives Questionnaire-Revised, HMQ-R = Heroin Motives Questionnaire-Revised, HADS = Hospital Anxiety and Depression Scale, IES-R = Impact of Events Scale-Revised).

15.2 Tests of the research hypotheses

15.3 Comparison of motives for substance use between those with and without PTSD

An independent samples t-test was conducted to compare coping-related motives for substance use scores between those with and without PTSD. Participants with PTSD endorsed coping-related motives for substance use significantly more than participants without PTSD and a large effect size was detected (t (70) = 11.57, $p < 0.001$, $d = 2.73$).

An independent samples t-test was conducted to compare social-related motives for substance use scores between participants with and without PTSD. A large significant effect was found with participants in the PTSD group endorsing social-

related motives for substance use significantly less than participants in the no-PTSD (t (70) = 4.12, $p < 0.001$, $d = 0.97$).

Independent samples t-tests were carried out to compare enhancement and conformity-related motives for substance use scores between those with and without PTSD. There were no significant differences between participants with and without PTSD for scores on the enhancement (t (58.72) = 1.245, $p = 0.218$) or the conformity (t (70) = 1.162, $p = 0.250$), motives for substance use subscales. However, the non-parametric equivalent (Mann-Whitney U) did find significant differences between the groups. For the enhancement subscale, participants with PTSD scored significantly lower than those participants without PTSD and a small effect size was detected (U = 436.5, $p = 0.016$, $r = 0.28$). Participants with PTSD also endorsed conformity-related motives significantly less than those without PTSD and a medium effect size was detected (U = 406.5, $p = 0.005$, $r = 0.33$).

15.4 Comparison of Substance use severity for those with and without PTSD

Figure 2 displays the number of participants with and without PTSD who scored within the 'intermediate', 'substantial' and 'severe' categories for substance use severity as measured by the MAST and the DAST. There was a significant association between PTSD status and substance use severity categories (X^2 (2) = 20.62, $p < 0.001$, $N = 72$). The calculated odds ratio (OR) indicated that participants with PTSD were 7.14 times more likely to fall within the 'severe' category for substance use severity than participants without PTSD.

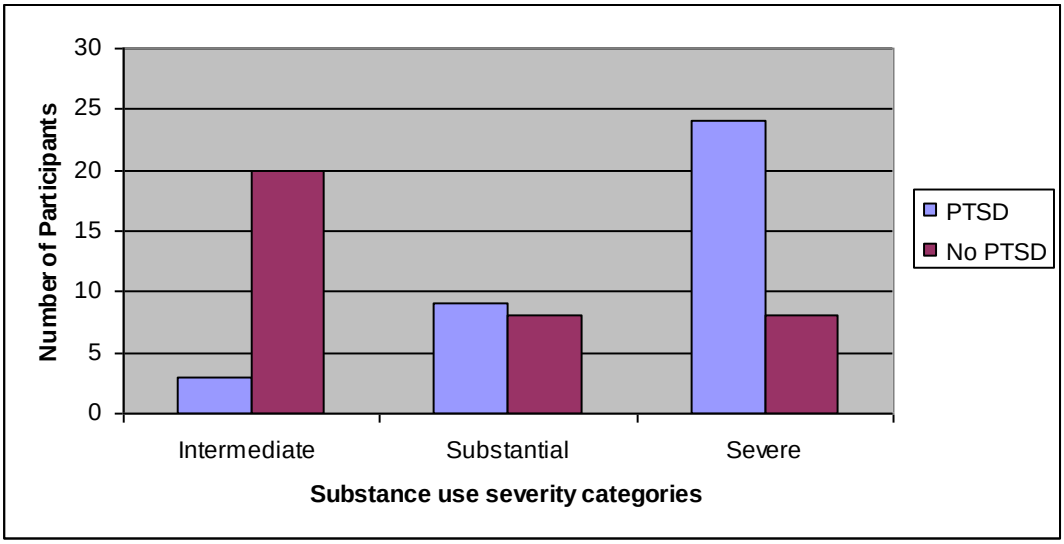

Figure 2. Number of participants with and without PTSD within each of the substance use severity categories as measured by the MAST/DAST. (MAST = Michigan Alcoholism Screening Test, DAST = Drug Abuse Screening Test).

Figure 3 displays the number of participants with and without PTSD who responded 'not at all', 'slightly', 'moderately', and 'considerably' and 'extremely' to question E24 of the ASI, which asked 'how troubled or bothered have you been in the past 30 days by alcohol/drug problems'. There was a significant association between PTSD status and responses to this question (X^2 (4) = 23.62, p < 0.001, N = 72). The calculated OR indicated that participants with PTSD were 7.12 times more likely to have selected 'extremely' in response to this question than participants without PTSD.

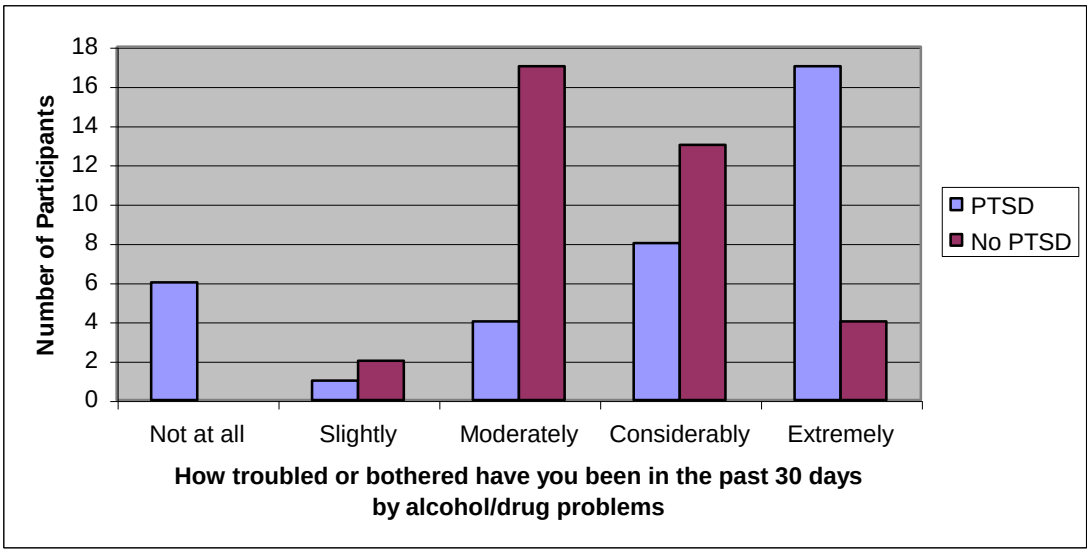

Figure 3. Responses from participants with and without PTSD to the ASI question (E24) 'how troubled or bothered have you been in the past 30 days by alcohol/drug problems'. (ASI = Addiction Severity Index).

Figure 4 displays the number of participants with and without PTSD who responded 'not at all', 'slightly', 'moderately', 'considerably' and 'extremely' to question E25 of the ASI, which asked 'how important to you now is treatment for alcohol/drug problems'. Responses to this question were significantly associated with PTSD status (X^2 (4) = 25.41, $p < 0.001$, $N = 72$). The OR indicated that participants with PTSD were 12.42 times more likely to have selected 'extremely' in response to this question than participants without PTSD.

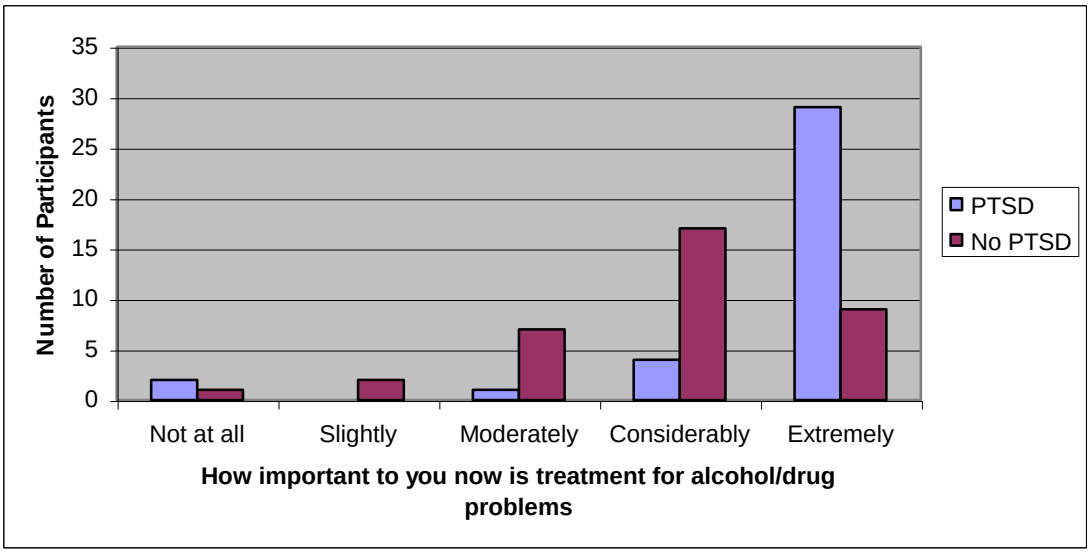

Figure 4. Responses from participants with and without PTSD to the ASI question (E25) 'how important to you now is treatment for alcohol/drug problems'. (ASI = Addiction Severity Index).

15.5 Comparison of HADS scores for those with and without PTSD

An independent samples t-test was conducted to compare anxiety and depression scores for those with and without PTSD. As hypothesised, participants with PTSD obtained significantly higher anxiety (t (70) = 7.73, $p < 0.001$, d = 1.85) and depression (t (56.55) = 3.83, $p < 0.001$, d = 1.02) scores in comparison to participants without PTSD and large effect sizes were detected.

15.6 Relationship between coping-related motives and IES-R subscale scores

For participants in the PTSD group, a Pearson's correlation was carried out to test for associations between scores on the coping-related motives for substance use subscale and scores on each of the IES-R subscales (re-experiencing, avoidance, hyperarousal). No significant associations were found.

Additional Pearson's correlations were carried out to explore associations between the remaining motives (enhancement, social, conformity) for substance use scales and each of the IES-R subscales for the PTSD group. Scores on the enhancement-related motives for substance use subscale were significantly associated with avoidance scores (r = 0.391, N = 36, p = 0.018). No further significant associations were observed between the motives and IES-R subscales.

16. Discussion

The goal of the current study was to compare motives for substance use in the presence and absence of PTSD in a treatment-seeking sample of SUD patients. A large significant effect was found for the main research hypothesis. Specifically, participants with comorbid SUD and PTSD endorsed coping-related motives for substance use significantly more than participants without PTSD. Greater coping-related motives for substance use among individuals with PTSD is consistent with prior work suggesting that individuals with PTSD use substances to cope (e.g. Grayson and Nolen-Hoeksema, 2005; Schuck and Widom, 2001). Furthermore, findings indicated that participants with PTSD endorsed social, enhancement and conformity-related substance use motives significantly less than participants without PTSD. This suggests that individuals with PTSD use substances for distinctively different reasons than those without PTSD. This has important implications for treatment providers, particularly in light of the extant literature demonstrating that individuals with comorbid PTSD and SUD have poorer treatment prognoses (Ford et al., 2007; Najavits, 2005). For example, it may be clinically useful to integrate coping skills into treatments for substance users with PTSD to help reduce their reliance on substances as a coping mechanism. Such findings also highlight the importance of

carrying out individual formulations as generic treatments targeting substance use may fail to meet the needs of patients with comorbid PTSD and SUD.

Results suggest that individuals with comorbid SUD and PTSD are likely to have more severe SUD symptoms than individuals without PTSD. This finding is in line with previous research investigating severity of substance use for individuals with PTSD (e.g. Reynolds et al., 2004). It is also consistent with research demonstrating a link between PTSD and elevated use of substances (Villagonzalo et al., 2011). Taken together, these findings suggest that psychological distress associated with exposure to trauma may be a risk factor for the progression of more severe substance use (Clark et al., 2001). Substance use may reduce the negative emotional responses associated with PTSD, therefore increasing the likelihood of future substance use (Clark et al., 2001). Further, substance use is likely to provide short-term relief from the distressing symptoms associated with PTSD, but in the long-term symptoms will be exacerbated (Reynolds et al., 2004). For instance, alcohol use is associated with memory impairment, and heroin use is associated with blunted affect, both of which are recognised features of PTSD (Reynolds et al., 2004). Similarly, impaired concentration, sleep disturbance, anxiety, irritability and intrusive images or flashbacks are features of PTSD, but may also accompany withdrawal from substances (Stewart et al., 1998). Thus, a 'vicious cycle' of PTSD symptomatology and substance use is likely to develop.

In line with the research hypothesis, participants with PTSD were found to have higher anxiety and depression scores in comparison to individuals without PTSD. The presence of elevated anxiety and depression symptoms alongside PTSD

symptoms and a lack of adaptive coping mechanisms are all factors that are perhaps contributing to the heightened levels of severity of substance use observed in the current sample. However, this is a speculation and further analysis with a larger sample and different research design is required to establish how much each variable contributes towards the relationship between PTSD and SUD. That is, the design of the current study does not allow for causal inferences regarding the relation between PTSD symptoms and increased use of substances to cope. It is plausible that general heightened negative affect, as indicated by anxiety and depression scores in the current sample, result in elevated use of substances to cope. Additionally, variables not accounted for in the current study such as, emotion regulation difficulties, may partially explain increased coping related motives for substance use in the presence of PTSD.

Consisten] nb#'.t with prior research investigating comorbid PTSD and SUD (e.g. Read et al., 2004; Smith et al., 2010), there was a trend for the PTSD group to have an earlier age of onset of substance use. As such, individuals with PTSD tended to have a longer duration of lifetime substance use than those without PTSD. However, this finding was not significant. Additionally, patients with PTSD reported being significantly more troubled by their substance use in the past 30 days and viewed treatment for their SUD as significantly more important than their counterparts.

PTSD symptoms, lengthy substance use histories, higher rates of anxiety and depression, and more severe SUD profiles will ultimately influence the success of any treatment targeting substance use. As such, these are important variables that need to be taken into account by service providers. Undergoing any type of treatment aimed

at reducing substance use without diagnosis and management of PTSD symptoms may result in a pattern where PTSD symptoms are exacerbated and trigger increased substance use and/or relapse (Reynolds et al., 2004; Najavits, 2005). Indeed, there is evidence to suggest that when patients become drug and/or alcohol free (or even begin to reduce their substance use), PTSD symptoms markedly increase (Najavits, 2005). This is most likely the result of PTSD symptoms not being identified and thus not being targeted. Consequently, patients will quickly return to substance use in order to cope (Najavits, 2005). This may decrease patients' beliefs that services can help them and create conflict between patients and service providers. Treating SUD in the absence of any knowledge about PTSD symptoms is associated with higher relapse rates, poorer treatment outcomes, and ultimately greater use of Addiction Services (Najavits, 2005). Taking all of this information together, this study highlights the importance of routinely screening patients accessing Addiction Services for trauma and PTSD.

This study failed to find associations between coping-related motives for substance use and PTSD symptom clusters. This finding is contrary to research carried out with adolescents where coping motives were positively associated with each of the PTSD symptom clusters (e.g. Dixon et al., 2009). This is perhaps due to the differing sample characteristics and methodologies being used. The current study included participants who met diagnostic criteria for a SUD and PTSD. Dixon and colleagues' (2009) study included adolescents whose substance use and PTSD were established without use of formal diagnostic assessment. Furthermore, in the current study enhancement-related motives for substance use related negatively to avoidance PTSD symptoms. This is perhaps a reflection that patients with PTSD who have elevated

avoidance symptoms are motivated to use substances as a means of escaping or reducing the affective, behavioural and cognitive symptoms of PTSD. In this sense the current finding that enhancement-related motives are inversely associated with avoidance symptoms is not surprising. That is, patients with PTSD are not likely to be motivated to use substances to enhance their affect; in fact they wish to reduce their affect. On the other hand, the negative association could be the result of patients who are more avoidant being less likely to be in situations where they might use substances to feel good.

Results from the present study indicate that the self-medication hypothesis is a viable explanatory model for the relationship between SUD and PTSD. Findings suggest that treatment seeking adults with comorbid SUD and PTSD use substances to cope with negative affect. This is highlighted by the fact that those with PTSD in the current sample had evaluated levels of substance use severity, anxiety and depression scores. Furthermore, the PTSD group scored significantly lower on the conformity, social and enhancement-related motives subscales than patients without PTSD. This suggests that treatment-seeking adults with co-occurring PTSD and SUD have significantly different motivations for using substances in comparison to individuals without PTSD. Although coping-related motives were not associated with PTSD symptom clusters, this might be due to the subgroup analysis being relatively underpowered.

16.1 Limitations

In light of the self-medication hypothesis (Khantzian, 1997), it would have been of interest to compare age of onset of substance use to the age participants experienced their traumatic experience. However, 83.3 per cent of the PTSD group reported experiencing multiple, repeated and prolonged trauma histories. This meant that it was not possible to investigate the temporal course of trauma and substance use.

The design of the current study did not take into account potential explanatory factors underlying the relationship between coping related motives for substance use and PTSD. As such, it is difficult to draw firm conclusions regarding why individuals with PTSD use substances specifically for coping related reasons as compared to other motives for substance use.

Although diagnostic instruments were used to assess the presence of PTSD and SUD, the reliance of self-report measures to capture symptomatology introduces bias to the study. The sample size, although adequate to test the main hypothesis, made subgroup analyses relatively underpowered. Employing a cross-sectional design did not permit examination of the temporal relations of the variables studied. The cross-sectional design also means that although the self-medication hypothesis is a plausible explanation for the current findings, the idea that there might be something inherent in the present samples coping styles, which makes them more vulnerable to developing PTSD cannot be ruled out.

The racial/ethnic homogeneity of the current sample limits the generalisability of the findings. The sample consisted of adults with heroin/alcohol related substance use disorders and therefore may limit the generalisability of findings to other substances. Lastly, comparisons of motives for substance use amongst those with and without PTSD included both heroin and alcohol users. Results may have been different if these substances were examined separately. However, further exploratory analyses was undertaken to address this issue and results were relatively similar (see Chapter 5, extended results and discussion).

16.2 Conclusions and implications for future research

The current study contributes to the extant literature in that it supports previous findings suggesting that individuals with comorbid PTSD and SUD are motivated to use substances to cope with negative affect. Although a number of methodological limitations are inherent in the present study, it also had a number of strengths. It extends previous findings by using diagnostic instruments to confirm the presence of PTSD and SUD; by using a treatment seeking clinical sample representative of patients typically presenting to Addiction Services; and having a group without trauma histories to compare motives and symptomatology to which has the potential to reduce confounding.

It appears acceptable to reject the null hypotheses and conclude that patients with PTSD have more severe substance use profiles, elevated symptoms of depression and anxiety and use substances to cope with negative affect. However, the reasons why those with PTSD are more likely to endorse coping motives remains unclear.

It is possible that variables such as, anxiety sensitivity and emotion regulation difficulties, contribute to increased coping related motives for substance use in the current sample. Accounting for such factors was out with the scope of the present investigation. Future research incorporating a broader range of potential mediating variables may shed further light on the underlying relationship between PTSD and coping related motives for substance use.

Bearing in mind the methodological limitations identified in the current study, future research should aim to replicate the findings, employ prospective designs, increase sample size to allow detailed investigation of specific substance use and associations with PTSD symptoms and general negative affect, and perhaps consider further aspects of substance use behaviour such as total consumption and frequency of use. When this has been achieved, future investigations can begin to pay attention to a broader range of potential mediating factors which may further increase understanding about the complex relationship between PTSD and SUD.

Additionally, future research may benefit from investigating the current research question with qualitative methods. This would not only complement the present findings but also perhaps increase understanding about participants' views on the connection between PTSD and SUD. Indeed, whilst administering the questionnaires, participants consistently answered the research question in their own words. Inevitably, the quantitative questionnaires employed in the current study could not capture the breadth and depth of information pertaining to why traumatised people use substances.

References

Back S.E., Brady, K.T., Sonne, S., Verduin, M.L., 2006. Symptom improvement in co-occurring PTSD and alcohol dependence. J Nerv Met Dis. 194, 690-696.

Brown, P.J., Recupero, P.R., and Stout, R., 1995. PTSD substance abuse comorbidity and treatment utilization. Addict Behav. 20, 251-254.

Bujarski, S., Feldner, M.T., Lewis, S.F., Babson, K.A., Trainor, C.D., Leen-Feldner, E., Badour, C.L., and Bonn-Miller, M.O. 2012. Marijuana use among traumatic event exposed adolescents: Posttraumatic stress symptom frequency predicts coping motives for use. Addic Behav. 37, 53-59.

Cannon, D.S., Rubin, A., Keefe, C.K., Black, J.L., Keeka, J.K., and Phillips, L.A., 1992. Affective correlates of alcohol and cocaine use. Addic Behav.17, 517-524.

Chilcoat., H.D., and Breslau, N., 1998. Posttraumatic Stress Disorder and Drug Disorders Testing Causal Pathways. Arch Gen Psychiatry. 55(10), 913-917.

Clark, W.H., Masson, C.L., Delucchi, K.L., Hall, S.M., and Sees, K.L., 2001. Violent traumatic events and drug abuse severity. J Subst Abuse Treat. 20, 121-127.

Cohen, J., 1992. A Power Primer. Psychol Bull. 112(1), 155-159.

Cooper, M.L., 1994. Motivations for alcohol use among adolescents: Development of a four-factor model. Psychol Assessment. 6. 117-128.

Cooper, M.L., Russell, M., and George, W.H., 1988. Coping, expectancies, and alcohol abuse: A test of social learning formulations. J Abnorm Psychol. 97, 218-230.

Dixon, L.J., Leen-Feldner, E.W., Ham, L.S., Feldner, M.T., and Lewis, S.F., 2009. Alcohol use motives among traumatic event-exposed, treatment-seeking adolescents: Associations with posttraumatic stress. Addic Behav. 34, 1065-1068.

Erdfelder, E., Faul, F., and Buchner, A., 1996. GPOWER: A general power analysis programme. Behav Res Methods, Instrum, Comput. 28, 1-11.

Ford, J.D., Chapman, J.F., Hawke, J., and Albert, D., 2007. Trauma among youth in the juvenile justice system: critical issues and new directions. National centre for mental health and juvenile justice brief, U.S. Department of Health and Human Services, Washington, DC.

Grant, B.F., Stinson, F.S., Dawson, D.A., Chou, P., Dufour, M.C., Compton, W., Roger, P., Pickering, M.S., and Kaplan, K., 2004. Prevalance and co-occurrence of substance use disorders and independent mood and anxiety disorders. Arch Gen Psychiatry. 61(8), 807-816.

Grayson, C.E., and Nolen-Hoesksema, S., 2005. Motives to drink as mediators between childhood sexual assault and alcohol problems in adult women. J Traumatic Stress. 18, 137-145.

Green, B.L., 1996. Trauma History Questionnaire. In B. H. Stamm (Ed.), Measurement of stress, trauma, and adaptation (pp. 366-369). Sidran Press, Lutherville, MD.

Grottfredson, D. C., and Wilson, D. B., 2003. Characteristics of effective school-based substance abuse prevention. Prev Sci. 4, 27-38.

Hien, D.A., Jiang, H., Campbell, A.N.C., Hu, M., Miele, G.M., Cohen, L.R., Brigham, G.S., Capstick, C., Kulaga, A., Robinson, J., Suarez-Morales, L., and Nunes, E.V., 2010. Do treatment improvements in PTSD severity affect substance outcomes? A secondary analysis from a randomised clinical trial in NIDA's clinical trials network. Am J Psychiatry. 167, 95-101.

Howard, D., Chilcoat, S.D., and Breslau, N., 1998. Post Traumatic Stress Disorders and Drug Disorders. Arch Gen Psychiatry. 55, 913-917.

Jacobsen, L.K., Southwick, S.M., and Kosten, T.R., 2001. Substance use disorders in patients with posttraumatic stress disorder: a review of the literature. Am J Psychiatry. 158, 1184-1190.

Khantzian, E.J., 1997. The self-medication hypothesis of substance use disorders: A reconsideration and recent applications. Harvard Rev Psychiat. 4, 231-244.

McLellan, A.T., Alterman, A.I., Cacciola, J., Metzger, D., and O'Brien, C.P., 1992.

The fifth edition of the addiction severity index. J Subst Abuse Treat. 180, 101-110.

Merikangas, K.R., Mehta, R.L., Molnar, B.E., Walters, E.E., Swendsen, J.D., Aguilar-Gaziola, S., Bijl, R., Borges, G., Caraveo-Anduaga, J.J., DeWit, D.J., Kolody, B., Vega, W.A., Wittchen, H.U., and Kessler, R.C., 1998. Comorbidity of substance use disorders with mood and anxiety disorders: Results of the international consortium in psychiatric epidemiology. Addic Behav. 23(6), 893-907.

Najavits, L.M., 2002. Clinicians' views on treating posttraumatic stress disorder and substance use disorder. J Subst Abuse Treat. 22, 79-85.

Najavits, L.M., 2005. Theoretical perspective on posttraumatic stress disorder and substance use disorder. Aust Psychol. 40, 118-123.

Nishith, P. Resick, P.A., and Mueser, K.T., 2001. Sleep difficulties and alcohol use motives in female rape victims with posttraumatic stress disorder. J Traumatic Stress. 14(3), 469-479.

Read, J.P., Brown, P.J., and Kahler, C.W., 2004. Substance use and posttraumatic stress disorders: symptom interplay and effects on outcome. Addict Behav. 29, 1665-1672.

Reynolds, M., Mezey, G., Chapman, M., Wheeler, M., Drummond, C., and Baldacchino, A., 2004. Co-morbid post-traumatic stress disorder in a substance misusing clinical population. Drug Alcohol Depen. 77, 251-258.

Schafer, I., and Najavits, L.M., 2007. Clinical challenges in the treatment of patients with posttraumatic stress disorder and substance abuse. Curr Opin Psychiatry. 20, 614-618.

Schuck, A.M., and Widom, C.S., 2001. Childhood victimisation and alcohol symptoms in females: Causal inferences and hypothesised mediators. Child Abuse Negl. 25, 1069-1092.

Selzer, M.L., 1971. The Michigan Alcoholism Screening Test: The quest for a new diagnostic instrument. Am J Psychiat. 127, 1653-1658.

Sheehan, D.V., Lecrubier, Y., Sheehan, H., Amorim, P., Janavs, J., Weiller, E., Hergueta, T., Baker, R., and Dunbar, G.C. 1998. The Mini International Neuropsychiatric Interview (M.I.N.I): The development and validation of a structured diagnostic psychiatric interview for DSM-IV and ICD-10. J Clin Psychiat. 59, 22-33.

Skinner, H.A., 1979. A multivariate evaluation of the MAST. J Stud Alcohol. 40(9), 831-844.

Smith, R.C., Blumenthal, H., Badour, C., and Feldner, M.T., 2010. An investigation of relations between crystal methamphetamine use and posttraumatic stress disorder. Addict Behav. 35, 625-627.

Spencer, C., Castle, D., and Michie, P.T., 2002. Motivations that maintain substance use among individuals with psychotic disorders. Schizophr Bull. 28(2), 233-247.

Stewart, S.H., 1996. Alcohol abuse in individuals exposed to trauma: A critical Review. Psychol Bull. 120, 83-112.

Tull, M.T., Gratz, K.L., Aklin, W.M., and Lejuez, C.W., 2010. A preliminary examination of the relationships between posttraumatic stress symptoms and crack/cocaine, heroin, and alcohol dependence. J Anxiety Disord. 24, 55-62.

Villagonzalo, K.A., Dodd, S., Ng, F., Mihaly, S., Langbein, A., and Berk, M., 2011. The relationship between substance use and posttraumatic stress disorder in a methadone maintenance treatment program. Compr Psychiat. 52, 562-566.

Weiss, D.S. and Marmar, C.R., 1996. The Impact of Event Scale-Revised. In J. Wilson and T. M., Keane (Eds.), Assessing psychological trauma and PTSD (pp. 399-411). Guilford, New York.

Zigmond, A.S., and Snaith, R.P., 1983. The Hospital Anxiety and Depression Scale. Acta Psychiat Scand. 67(6), 361-370.

Chapter 5: Empirical Project Extended Results & Discussion

Motives for substance use in the presence and absence of Post Traumatic Stress Disorder (PTSD)

17. Extended Results

17.1 Parametric assumptions

Prior to beginning analyses, tests of normality of distribution and homogeneity of variance were carried out to evaluate the data against assumptions for parametric tests. The assumptions of parametric data were tested for those with and without PTSD (regardless of SUD type) and by SUD type (alcohol versus heroin, regardless of PTSD status).

17.2 Distribution of data PTSD versus no-PTSD

After inspection of histograms and Q-Q plots, the Kolmogorov-Smirnov (*D*) test was used to determine if the distribution of scores differed significantly from normality. If the Kolmogorov-Smirnov test is significant ($p < 0.05$), data are said to have significantly non-normal distributions.

Table 6 displays the results of the Kolmogorov-Smirnov tests for the motives, anxiety and depression scores for participants with and without PTSD.

Table 6. Distribution of scores on the DMQ-R/HMQ-R and HADS subscales for participants with and without PTSD.

	PTSD (*N* = 36)		No-PTSD (*N* = 36)	
	D	*p*	*D*	*p*
DMQ-R/HMQ-R				
Coping	0.179	0.005	0.150	0.040
Enhancement	0.195	0.001	0.194	0.001
Social	0.236	< 0.001	0.236	< 0.001
Conformity	0.297	< 0.001	0.114	0.200
HADS				
Anxiety	0.210	< 0.001	0.147	0.049
Depression	0.139	0.078	0.139	0.077

(DMQ-R = Drinking Motives Questionnaire-Revised, HMQ-R = Heroin Motives Questionnaire-Revised, HADS = Hospital Anxiety and Depression Scale).

17.3 Distribution of data heroin versus alcohol

Table 7 displays the results of the Kolmogorov-Smirnov test for the motives, anxiety and depression scores for participants with a heroin and alcohol related substance use disorder.

Table 7. Distribution of scores on the DMQ-R/HMQ-R and HADS subscales by SUD type.

	Alcohol related SUD (*N* = 37)		Heroin related SUD (*N* = 35)	
	D	*p*	*D*	*p*
DMQ-R/HMQ-R				
Coping	0.163	0.014	0.161	0.022
Enhancement	0.238	< 0.001	0.108	0.222
Social	0.160	0.018	0.193	0.002
Conformity	0.205	< 0.001	0.233	<0.001
HADS				
Anxiety	0.159	0.19	0.155	0.033
Depression	0.160	0.017	0.141	0.076

(DMQ-R = Drinking Motives Questionnaire-Revised, HMQ-R = Heroin Motives Questionnaire-Revised, HADS = Hospital Anxiety and Depression Scale).

Table 8 displays the results for the PTSD group of the Kolmogorov-Smirnov test for scores on the IES-R subscales for participants with a heroin and alcohol related SUD.

Table 8. Distribution of scores for the PTSD group on the IES-R subscales by SUD type

	Alcohol related SUD (N = 19)		Heroin related SUD (N = 17)	
	D	*p*	*D*	*p*
IES-R				
Re-experiencing	0.246	0.004	0.178	0.159
Avoidance	0.266	0.001	0.186	0.123
Hyperarousal	0.240	0.005	0.266	0.002
Total	0.245	0.004	0.189	0.110

(IES-R = Impact of Events Scale-Revised).

17.4 Homogeneity of variance

Levene's test was used to assess equality of variance for those with and without PTSD (regardless of SUD type) and by SUD type (alcohol versus heroin, regardless of PTSD status). If Levene's test is significant ($p < 0.05$), this indicates that the assumption of equal variances has been violated. If this assumption is violated, it can be corrected by reporting the test statistic that does not assume equal variances (Welch's *t*-test). Unequal variances are reported below.

17.5 Motives for substance use subscales

Variances were significantly different for the enhancement-related motives for substance use scores between participants with and without PTSD (F (1, 70) = 7.01, $p < 0.01$).

Variances were also significantly different for the DMQ-R enhancement subscale between participants with and without PTSD (F (1, 37) = 7.33, $p < 0.05$).

17.6 HADS depression scores

Variances were significantly different for depression sores between participants with and without PTSD (F (1, 70) = 15.13, $p < 0.01$).

Variances for the alcohol group were significantly different for depression sores between participants with and without PTSD (F (1, 37) = 9.09, $p < 0.05$).

Variances for the heroin group were significantly different for depression sores between participants with and without PTSD (F (1, 35) = 14.3, $p < 0.05$).

17.7 Further analyses

Additional exploratory analyses were undertaken to investigate the relationship between PTSD status, motives for substance use, severity of substance use, HADS scores, PTSD symptom clusters and, specific substance use (alcohol versus heroin).

17.8 Descriptive data

Table 9 displays descriptive data for participants with and without PTSD in relation to SUD type (alcohol versus heroin) for the following variables 1) motives (DMQ-R/HMQ-R) for substance use subscale scores, 2) HADS anxiety and depression scores, 3) substance use age of onset, and 4) the IES-R total, hyperarousal, re-experiencing and avoidance scores.

Table 9. Descriptive data by SUD type for clinical variables for participants with and without PTSD.

	PTSD alcohol (N = 19) M (SD)	No-PTSD alcohol (N = 18) M (SD)	PTSD heroin (N = 17) M (SD)	No-PTSD heroin (N = 18) M (SD)
DMQ-R/ HMQ-R				
Coping	22.05 (2.48)	10.89 (3.23)	22.05 (3.93)	14.34 (3.33)
Enhancement	12.21 (4.58)	11.94 (2.62)	9.7 (2.73)	12.05 (2.41)
Social	9.63 (5.57)	16.5 (3.18)	7.23 (3.54)	9.67 (2.97)
Conformity	7.36 (4.46)	8.5 (2.2)	6.41 (2.35)	6.94 (1.67)
HADS				
Anxiety	17 (4.49)	8 (3.32)	17.65 (4.12)	11.78 (3.47)
Depression	14.21 (5.69)	7.94 (2.75)	13.88 (6.2)	11.5 (3.17)
Age of onset	12.79 (2.39)	17.39 (3.24)	17.18 (4.16)	21.17 (4.18)
IES-R				
Hyperarousal	19.79 (4.42)	-	19.41 (5.25)	-
Intrusion	25.68 (6.22)	-	25.47 (6.65)	-
Avoidance	24.31 (14.29)	-	24.23 (4.87)	-
Total	69.79 (22.86)	-	69.11(15.63)	-

(DMQ-R = Drinking Motives Questionnaire-Revised, HMQ-R = Heroin Motives Questionnaire-Revised, HADS = Hospital Anxiety and Depression Scale, IES-R = Impact of Events Scale-Revised).

17.9 Comparison of alcohol use motives (DMQ-R) between participants with and without PTSD

An independent samples t-test was carried out to compare coping-related motives for alcohol use subscale scores between those with and without PTSD. Participants with PTSD endorsed coping-related motives for alcohol use significantly more than participants without PTSD and a large effect size was detected (t (35) = 11.82, p < 0.001, d = 3.99).

An independent samples t-test was carried out to compare social-related motives for alcohol use subscale scores between those with and without PTSD. Participants with PTSD endorsed social-related motives for alcohol use significantly less than participants without PTSD and a large effect size was detected (t (35) = 4.57, p < 0.001, d = 1.54).

Independent samples t-tests were carried out to compare enhancement and conformity-related motives subscale scores for participants with and without PTSD. There were no significant differences between participants with and without PTSD on the enhancement (t (28.95) = 0.22, p > 0.05) or the conformity (t (35) = 0.969, p > 0.05), motives for alcohol use subscales. However, non-parametric equivalents (Mann-Whitney U) did find significant differences between the groups on the conformity subscale. Participants with PTSD scored significantly lower than those participants without PTSD and a medium effect size was detected (U = 255.5, p = 0.009, r = 0.43).

18. Comparison of heroin use motives (HMQ-R) between participants with and without PTSD

An independent samples t-test was carried out to compare coping-related motives for heroin use subscale scores between those with and without PTSD. Participants with PTSD endorsed coping-related motives for heroin use significantly more than participants without PTSD and a large effect size was detected (t (33) = 11.82, p < 0.001, d = 3.99).

Independent sample t-tests were carried out to compare social and enhancement-related motives for heroin use subscale scores between participants with and without PTSD. Participants with PTSD had significantly lower scores on the social (t (33) = 2.204, p < 0.05, d = 0.77) and enhancement (t (33) = 2.7, p < 0.05, d = 0.94) motives for heroin use subscales than participants without PTSD, medium and large effect sizes were detected.

An independent samples t-test was carried out to compare conformity-related motives for heroin use subscale scores between participants with and without PTSD. There were no significant differences between the groups on the conformity-related motives for heroin use subscale (t (33) = 0.78, p > 0.05).

18.1 Comparison of severity of alcohol use categories for those with and without PTSD

Figure 5 displays the number of participants with and without PTSD who scored within the 'intermediate', 'substantial' and 'severe' categories for alcohol use severity as measured by the MAST. There was a significant association between PTSD status

and substance use severity category (X^2 (2) = 22.95, $p < 0.05$, $N = 37$). The calculated OR indicated that participants with PTSD were 13.68 times more likely to fall within the 'severe' category for alcohol use severity than participants without PTSD.

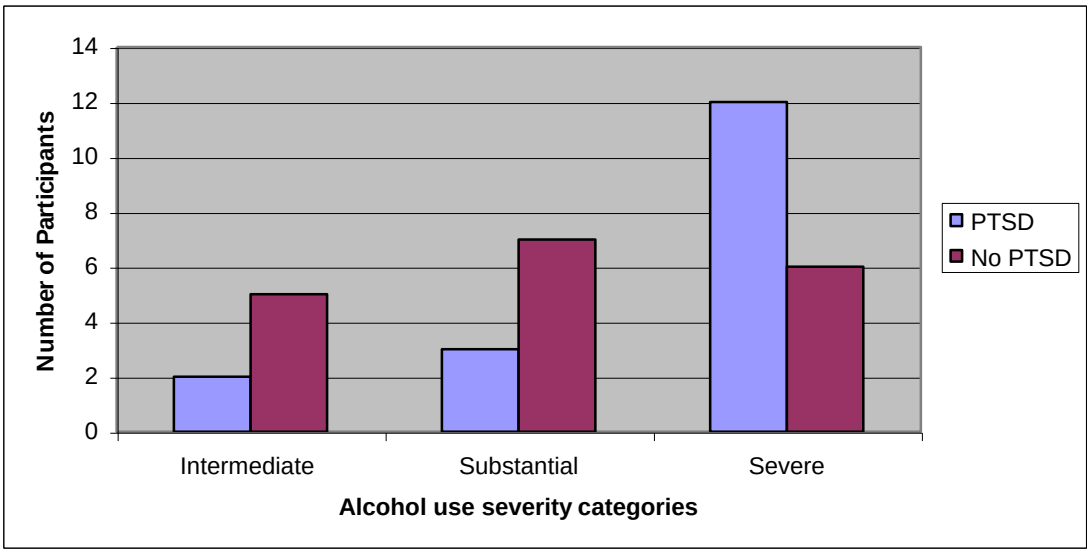

Figure 5. Number of participants with and without PTSD within each of the alcohol use severity categories as measured by the MAST. (MAST = Michigan Alcoholism Screening Test).

18.2 Comparison of responses to the ASI questions for alcohol users

Figure 6 displays the number of participants with and without PTSD that responded 'not at all', 'slightly', 'moderately', 'considerably' and 'extremely' to question E24 of the ASI which asked 'how troubled or bothered have you been in the past 30 days by alcohol problems'. Responses to this question were significantly different between the groups (X^2 (4) = 13.31, $p < 0.05$, $N = 37$). The calculated OR indicated that participants with PTSD were 7.94 times more likely to select 'extremely' in response to this question compared to those without PTSD.

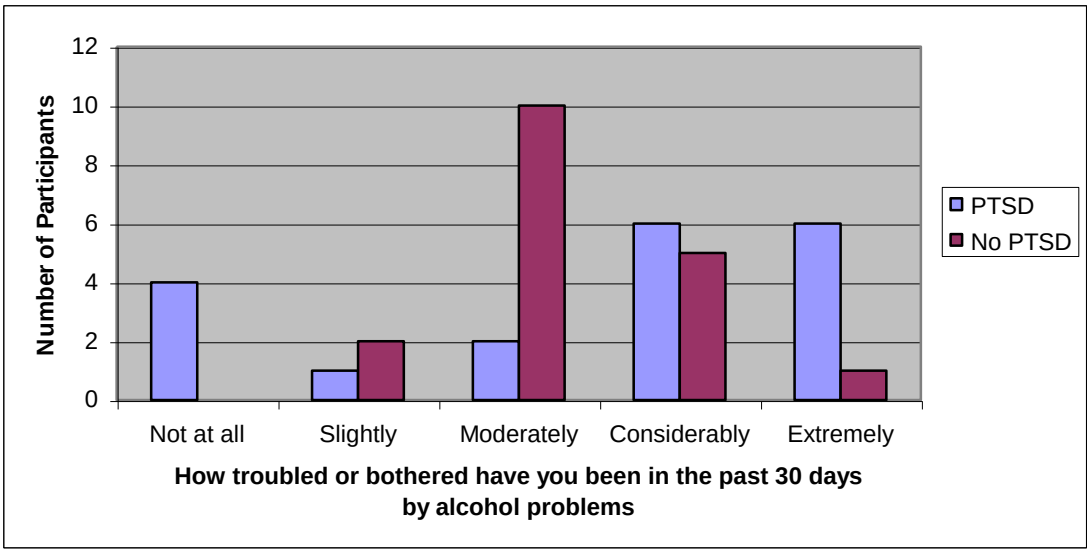

Figure 6. Responses from participants with and without PTSD to the ASI question (E24) 'how troubled or bothered have you been in the past 30 days by alcohol problems'. (ASI = Addiction Severity Index).

Figure 7 displays the number of participants with and without PTSD that responded 'not at all', 'slightly', 'moderately', 'considerably' and 'extremely' to question E25 of the ASI, which asked 'how important to you now is treatment for alcohol problems'. There was a significant association between PTSD status and responses to this question (X^2 (4) = 20.17, $p < 0.001$, $N = 37$). The OR indicated that participants with PTSD were 6.15 times more likely to select 'extremely' in response to this question compared to those without PTSD.

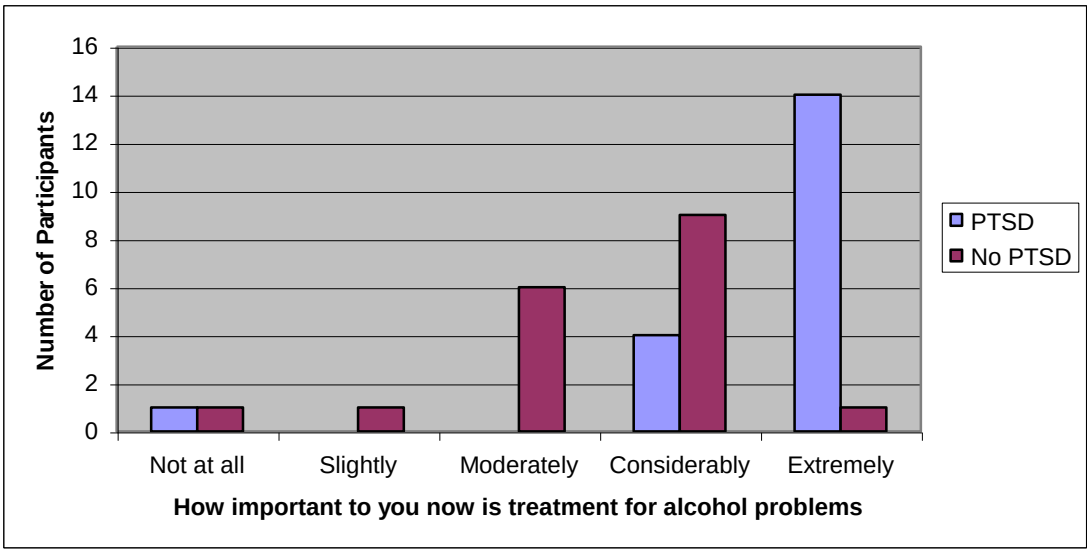

Figure 8. Responses from participants with and without PTSD to the ASI question (E25) 'how important to you now is treatment for alcohol. (ASI = Addiction Severity Index).

18.3 Comparison of severity of heroin use categories for those with and without PTSD

Figure 9 displays the number of participants with and without PTSD who scored within the 'intermediate', 'substantial' and 'severe' categories for heroin use severity as measured by the DAST. Although there were more participants with PTSD within the 'severe' category the association was not significant (X^2 (2) = 4.86, $p > 0.05$, N = 35).

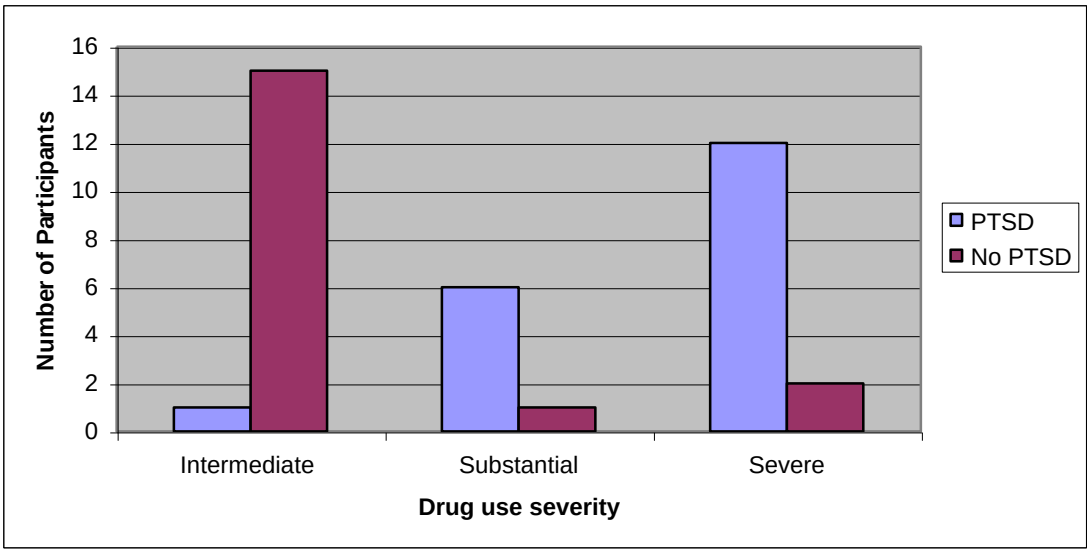

Figure 9. Number of participants with and without PTSD within each of the drug use severity categories as measured by the DAST. (DAST = Drug Abuse Screening Test).

18.4 Comparison of responses to the ASI questions for heroin users

Figure 10 displays the number of participants with and without PTSD that responded 'not at all', 'slightly', 'moderately', 'considerably' and 'extremely' to question E24 of the ASI, which asked 'how troubled or bothered have you been in the past 30 days by drug problems'. There was a significant association between PTSD status and responses to this question (X^2 (3) = 12.93, $p < 0.05$, N = 35). The calculated OR indicated that participants with PTSD were 9.15 times more likely to select 'extremely' in response to this question compared to those without PTSD.

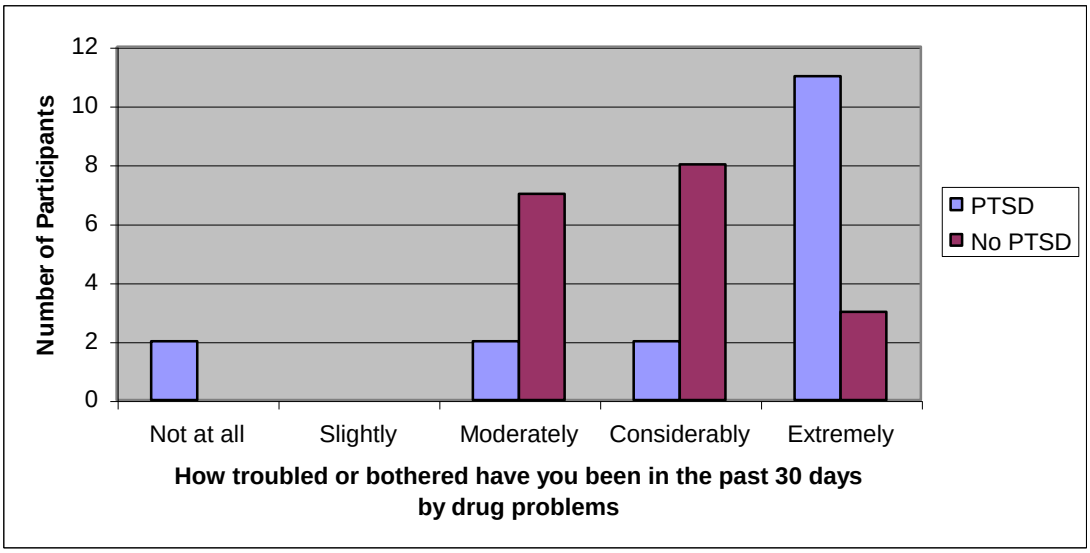

Figure 10. Responses from participants with and without PTSD to the ASI question (E24) 'how troubled or bothered have you been in the past 30 days by drug problems'. (ASI = Addiction Severity Index).

Figure 11 displays the number of participants with and without PTSD that responded 'not at all', 'slightly', 'moderately', 'considerably' and 'extremely' to question E25 of the ASI, which asked 'how important to you now is treatment for drug problems'. There was a significant association between PTSD status and responses to this question (X^2 (4) = 12.11, $p < 0.05$, N = 35). The calculated OR indicated that participants with PTSD were 9.37 times more likely to select 'extremely' in response to this question compared to those without PTSD.

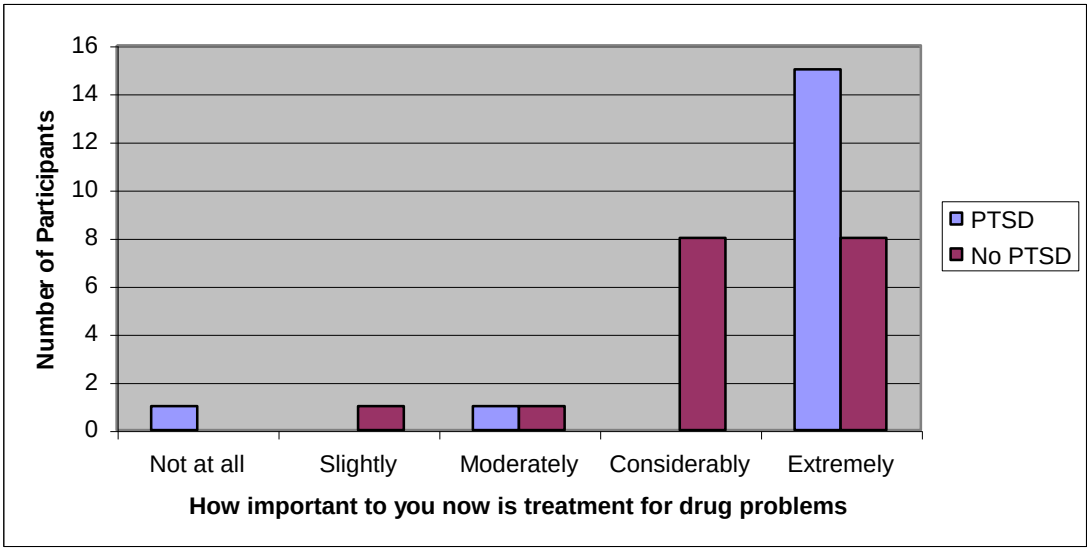

Figure 11. Responses from participants with and without PTSD to the ASI question (E25) 'how important to you now is treatment for drug problems'. (ASI = Addiction Severity Index).

18.5 Comparison of HADS scores for those with and without PTSD for alcohol and heroin users

For participants with an alcohol related SUD an independent samples t-test was conducted to compare anxiety and depression scores between those with and without PTSD. Participants with an alcohol related SUD and comorbid PTSD obtained significantly higher anxiety (t (35) = 6.89, $p < 0.001$, d = 2.32) and depression (t (26.29) = 4.22, $p < 0.001$, d = 1.65) scores as compared to participants without PTSD and large effect sizes were detected.

For participants with a heroin related SUD an independent sample t-test was carried out to compare anxiety and depression scores between those with and without PTSD. Participants with a heroin related SUD and comorbid PTSD obtained significantly higher anxiety scores in comparison to participants without PTSD and a large effect size was detected (t (33) = 4.56, $p < 0.001$, d = 1.59). Although participants with a

heroin related SUD and comorbid PTSD had higher depression scores on average, the difference between the groups was not significant (t (23.5) = 1.41, $p > 0.05$).

18.6 Comparison of motives for heroin use and alcohol use for those with PTSD

Independent sample t-tests were carried out to compare DMQ-R and HMQ-R subscale scores amongst participants with PTSD. There were no significant differences between the heroin and alcohol use motives subscales scores for individuals with PTSD.

18.7 Relationship between specific substance use (alcohol versus heroin) and PTSD symptom clusters

Associations between each of the motives for alcohol use subscale scores as measured by the DMQ-R and each of the PTSD symptom clusters as measured by the IES-R were evaluated with use of Pearson's correlation. Enhancement-related motives were significantly associated with avoidance (r = 0.532, N = 19, p = 0.019), re-experiencing (r = 0.565, N = 19, p = 0.012), and hyperarousal (r = 0.542, N = 19, p = 0.017) symptoms of PTSD. No further significant associations were observed between alcohol motives and IES-R scales.

Associations between each of the motives for heroin use subscales as measured by the HMQ-R and each of the PTSD symptom clusters as measured by the IES-R were evaluated with use of Pearson's correlation. No significant relationships were found between any of the heroin motives subscale scores and the IES-R subscale scores.

18.8 Internal reliability of the DMQ-R and the HMQ-R

The internal reliability of the DMQ-R and the HMQ-R measures were assessed using Cronbach's alpha. The internal reliability was assessed for SUD group (alcohol versus heroin) for all participants and separately for the PTSD (alcohol versus heroin) and no-PTSD groups (alcohol versus heroin). Several items were identified as having a corrected item-total correlation of 0.4 or below and were significantly reducing Cronbach's alpha. In such cases, the item(s) were removed and analyses (independent sample t-tests) were then conducted without the problematic items.

18.9 Internal reliability of the DMQ-R and HMQ-R for all participants

Internal reliabilities for the DMQ-R were good (coping: $\alpha = 0.91$; social: $\alpha = 0.95$; enhancement: $\alpha = 0.72$; conformity: $\alpha = 0.85$).

Internal reliabilities for the HMQ-R were variable (coping: $\alpha = 0.92$; social: $\alpha = 0.84$; enhancement: $\alpha = 0.64$; conformity: $\alpha = 0.64$). Two items (questions 9 and 13) of the enhancement-related motives for heroin use were below 0.4 for the corrected item-total correlation. When these items were removed there continued to be no significant difference between participants with and without PTSD on the enhancement-related motives for substance use scale (t (57.64) = 0.84, $p > 0.05$).

Three items (questions 2, 8 and 19) of the conformity-related motives for heroin use were below 0.4 for the corrected item-total correlation. When these items were removed there continued to be no significant difference between participants with and

without PTSD on the conformity-related motives for substance use scale (t (70) = 0.6, $p > 0.05$).

18.9.1 Internal reliability of the DMQ-R for participants with and without PTSD

Internal reliability for each of the DMQ-R subscales for the PTSD group was variable (coping: α = 0.38; social: α = 0.95; enhancement: α = 0.74; conformity: α = 0.89). Three items (questions 6, 15 and 17) of the coping-related motives for alcohol use were below 0.4 for the corrected item-total correlation for the PTSD group. Differences between participants with and without PTSD remained significant for the coping-related motives for alcohol use subscale when these items were removed (t (24.74) = 14.93, $p < 0.001$, d = 6).

Internal reliability for each of the DMQ-R subscales for the no-PTSD group was also variable (coping: α = 0.79; social: α = 0.86; enhancement: α = 0.70; conformity: α = 0.64). Zero items of the conformity-related motives were below 0.4 for the corrected item-total correlation.

18.9.2 Internal reliability of the HMQ-R for participants with and without PTSD

Internal reliability for each of the HMQ-R subscales for the PTSD was variable (coping: α = 0.82; social: α = 0.77; enhancement: α = 0.48; conformity: α = 0.72). One item (question 13) of the enhancement-related motives for heroin use subscale was below 0.4 for the corrected item-total correlation. The finding that participants with PTSD had significantly lower scores on enhancement-related motives for heroin

use subscale than participants without PTSD remained true after item 13 was removed (t (33) = 3.48, p < 0.05, d = 1.12)

Internal reliability for each of the HMQ-R subscales for the no-PTSD group was also variable (coping: α = 0.86; social: α = 0.90; enhancement: α = 0.74; conformity: α = 0.48). One item (question 20) of the conformity-related motives for heroin use subscale was below 0.4 for the corrected item-total correlation. When this item was removed, participants with PTSD continued to endorse conformity-related motives less than participants without PTSD and the difference remained non significant (t (35) = 0.35, p > 0.05).

19. Extended discussion

19.1 Assumptions of parametric tests

Data were checked for normality of distribution and for homogeneity of variances. Analyses revealed that scores on the anxiety scale of the HADS, and on the social, enhancement and coping-related motives for substance use subscales, were not normally distributed for participants with and without PTSD. Scores on the conformity-related motives for substance use subscale were also not normally distributed for participants with PTSD. Variances were significantly unequal for scores on the depression scale of the HADS and for scores on the enhancement-related motives for substance use subscale for participants with and without PTSD.

Additionally, data were inspected by looking at SUD type (alcohol versus heroin). For participants with a SUD related to alcohol, scores were not normally distributed on any of the DMQ-R subscales, nor on the depression subscale of the HADS. For the PTSD group with an alcohol related SUD, scores were not normally distributed on any of the IES-R subscales. For participants with a SUD related to heroin, scores were not normally distributed on the coping, social and conformity-related subscales of the HMQ-R, nor on the anxiety subscale of the HADS. For the PTSD group with a heroin related SUD, scores were not normally distributed on the hyperarousal subscale of the IES-R.

Variances were significantly different for scores on the depression subscale of the HADS and the enhancement-related motives for substance use subscale between

participants with and without PTSD. Similarly, variances were significantly different for scores on the enhancement-related DMQ-R subscale between participants with and without PTSD. Depression scores for participants with a heroin and an alcohol related SUD also varied significantly between participants with and without PTSD.

Many researchers would not recommend using parametric tests when assumptions of distribution and homogeneity of variance are violated (Norman, 2010). However, the t-test is described as being sufficiently robust with respect to the assumption of normality (Norman, 2010). This means that even deviations away from normality do not significantly impact on type-one error rates (Clark-Carter, 2010). Clark-Carter (2010) notes that:

"..contribution of scores should be normally distributed or at least the summary statistic being evaluated should be normally distributed which in the case of the t-test of means is likely to be true if the sample has at least 40 participants" (p.198)

Additionally, Norman (2010) describes the idea of not being able to use parametric tests due to data being non-normally distributed as a myth. Norman (2010) argues that:

"…both theory and data converge on the conclusion that parametric methods examining differences between means, for sample sizes greater than 5, do not require the assumption of normality, and will yield nearly correct answers even for the manifestly non normal and asymmetric distributions…" (p.92)

Furthermore, it is unlikely that two clinical samples, even when drawn from the same population, will have exactly the same variance (Clark-Carter, 2010). Again, the t-test has been shown to be robust enough so that the variances can be different to a certain degree and the test will not be badly affected (Clark-Carter, 2010).

Consideration was given to the arguments for and against using parametric tests when assumptions are violated. The decision was made to select parametric tests given that they are more powerful and appear to be sufficiently robust, even when dealing with non-normal data with unequal variances (Norman, 2010). As a precautionary measure, non-parametric equivalents were also carried out. For the majority of analyses both parametric and non-parametric tests produced the same results. When differing results were obtained, the non-parametric equivalent was reported.

19.2 Additional analyses

The main analyses (Chapter 4), exploring differences between participants with and without PTSD, combined heroin and alcohol users. As such, the PTSD group and the no-PTSD group included participants with both alcohol and heroin related substance use disorders. Exploring the data in this way meant that scores on the DMQ-R and HMQ-R were combined and labelled as 'motives for substance use'. Similarly, DAST and MAST scores were combined and labelled substance use severity scores.

The possibility that examining SUD type separately might have affected the findings was considered and further analyses were carried out to investigate this (see extended results). However, results demonstrated that whether combining or separating SUD

type, the finding that participants with PTSD endorsed coping-related motives significantly more than participants without PTSD remained. There were some differences for the social, enhancement and conformity subscales when substances were examined separately. For the alcohol group, no significant differences were found between scores on the enhancement-related DMQ-R subscale for participants with and without PTSD. For the heroin group, there were no significant differences found between the conformity-related HMQ-R subscale for participants with and without PTSD. When SUD type was combined (Chapter 4) there were significant differences between scores on all of the motives subscales.

There were further differences in relation to substance use severity and HADS scores when substances were examined separately. For the heroin group, there were no significant differences in terms of drug severity categories and for depression scores on the HADS for participants with and without PTSD. For the PTSD group, heroin users scores on the DMQ-R did not significantly relate to any of the PTSD symptom clusters as measured by the IES-R. For alcohol users, enhancement-related motives for alcohol use correlated negatively with all of the IES-R subscales.

In general, results from the subgroup analyses were relatively in line with the results obtained when combining SUD type. However, given that some discrepancies did emerge, it is difficult to conclude whether specific substance use does or does not influence the findings. These discrepancies could be due to the subgroup analyses being relatively underpowered and thus a type two error may have occurred. On the other hand, carrying out multiple tests on the same data increases the likelihood of a type one error. Future research would benefit from exploring various substances with

large samples to establish whether specific substances do in fact produce differing results in terms of motivation for use. This is potentially an important line of future enquiry given that existing evidence demonstrates an association between specific substances and PTSD symptoms (e.g. Tull *et al.* 2010; Smith *et al.* 2010; Villagonzalo *et al.* 2011).

19.3 Internal reliability of the DMQ-R and HMQ-R

The internal reliability of both the DMQ-R and the HMQ-R were examined in two ways: 1) by separating alcohol and heroin users regardless of PTSD status, and 2) by separating alcohol and heroin users with regard to PTSD status. When the former method was used the internal reliability of all the DMQ-R subscales were good. However, the enhancement and conformity subscales of the HMQ-R were found to be somewhat less reliable.

When the later method was employed, internal reliabilities for both the DMQ-R and HMQ-R were variable. However, this analysis involved small numbers of participants and as such firm conclusions about reliability cannot be drawn.

There are no alternative measures, to the author's knowledge, that capture motives for substance use. Moreover, there are no measures in existence that have been specifically designed to capture motives for substance use in the presence of PTSD. As demonstrated, patients with comorbid SUD and PTSD have distinctively different motivations for using substances in comparison to patients without PTSD. As such, it would be of benefit for future research to not only test the reliability of the motives

questionnaire used in the current study with a range of different substances but also, to develop one designed specifically for use with a PTSD population. This would perhaps further increase understanding about the nature of the relationship between PTSD and SUD.

Additionally, the finding that only the enhancement-related motives for substance use and in particular heroin use was associated with PTSD symptoms could perhaps be a reflection of the limitations of the DMQ-R and HMQ-R. That is, the coping-related motives subscale measures internal, emotion regulation motives. Participants with PTSD had elevated levels of anxiety and depression. As such, participants with PTSD may have endorsed coping-related motives more than their counterparts, as they are motivated to use substances to cope with the negative affect associated with PTSD, such as increased anxiety and depression. On the other hand, a measure capturing motives for substance use in the context of PTSD symptoms may have produced different findings. For an illustrative example, instead of asking participants to rate how often they have used alcohol in the past year to "forget their worries", one could ask how often they have used alcohol in the past year to "forget about bad memories". This would help to establish whether use of substances relates to regulating general negative affect, or to specific symptoms associated with PTSD (e.g. re-experiencing, avoidance, hyperarousal).

19.4 Conclusion & recommendations

Although data used in the current study violated the assumptions of parametric tests, precautionary measures were taken to reduce the likelihood of committing a type one

error. Furthermore, parametric tests are robust enough that violations of assumptions should not significantly influence the findings.

Further sub-group analyses were carried out to investigate whether specific substance use produced a differential pattern of results. Some differences were found when heroin and alcohol were examined separately. However, the subgroup analyses involved small samples and as such firm conclusions cannot be drawn about specific substance use. Future research would benefit from investigating differing substances with larger samples. This would perhaps shed further light on the association between PTSD and SUD.

References

Alterman, A.I., McDermott, P.A., Cook, T.G., Metzger, D., Rutherford, M.J., Cacciola, J.S., *et al.* (1998). New scales to assess change in the Addiction Severity Index for the opioid, cocaine, and alcohol dependent. *Psychology of Addictive Behaviour, 12,* 233-246.

American Psychiatric Association, (2000). *Diagnostic and statistical manual of mental disorders (4th ed).* Washington, DC: Author.

Annis, H.M. & Martin, G. (1985). *Inventory of drug-taking situations.* Toronto: Addiction Research Foundation of Ontario.

Audit Scotland (2009). *Drug and alcohol services in Scotland*. Edinburgh: Author.

Back S.E., Brady, K.T., Sonne, S. & Verduin, M.L. (2006). Symptom improvement in co-occurring PTSD and alcohol dependence. *Journal of Nervous and Mental Disease, 194*, 690-696.

Back, S. E., Dansky, B.S., Coffeey, S.F., Saladin, M.E., Sonne, S. & Brady, K.T. (2000). Cocaine dependence with and without posttraumatic stress disorder: a comparison of substance use, trauma history and psychiatric comorbidity. *American Journal of Addictions, 9,* 51-62.

Back S.E., Jackson, J.L., Sonne, S. & Brady, K.T. (2005). Alcohol dependence and posttraumatic stress disorder: differences in clinical presentation and response to

cognitive-behavioural therapy by order of onset. *Journal of Substance Abuse Treatment, 29,* 29-37.

Back, S.E., Waldrop, A.E. & Brady, K.T. (2009). Treatment Challenges Associated with Comorbid Substance Use and Posttraumatic Stress Disorder: Clinicians' Perspectives. *American Journal on Addictions, 18,* 15-20.

Bjelland, I., Dahl, A.A., Haug, T.T. & Neckelmann, D. (2002). The validity of the Hospital Anxiety and Depression Scale. An updated literature review. *Journal of Psychosomatic Research, 52*(2), 69-77.

Black, N. (1996). Why we need observational studies to evaluate the effectiveness of health care. *British Medical Journal, 312,* 1215-1218.

Bornovalova, M.A., Ouimette, P., Crawford, A.V. & Levy, R. (2009). Testing gender effects on the mechanisms explaining the association between post-traumatic stress symptoms and substance use frequency. *Addictive Behaviours, 34,* 685-692.

Brady, K.T., Killeen, T., Saladin, M.E., Dansky, B.S. & Becker, S. (1994). Comorbid substance abuse and post-traumatic stress disorder: characteristics of women in treatment. *American Journal on Addictions, 3,* 160-164

Bremner, J.D., Southwick, S,M., Darnell, A. & Charney, D.S. (1996). Chronic PTSD in Vietnam Combat Veterans: Course of illness and Substance Abuse. *American Journal of Psychiatry, 153,* 369-375.

Brown, P.J., Recupero, P.R. & Stout, R. (1995). PTSD substance abuse comorbidity and treatment utilization. *Addictive Behaviours, 20,* 251-254.

Bujarski, S., Feldner, M.T., Lewis, S.F., Babson, K.A., Trainor, C.D., Leen-Feldner, E. *et al.* (2012). Marijuana use among traumatic event exposed adolescents: Posttraumatic stress symptom frequency predicts coping motives for use. *Addictive Behaviours, 37,* 53-59.

Cannon, D.S., Rubin, A., Keefe, C.K., Black, J.L., Keeka, J.K. & Phillips, L.A. (1992). Affective correlates of alcohol and cocaine use. *Addictive Behaviours, 17,* 517-524.

Centre for Reviews and Dissemination, (2009). *Systematic Reviews: CRD's guidance for undertaking reviews in health care.* York: University of York.

Chilcoat, H.D. & Breslau, N. (1998). Posttraumatic Stress Disorder and Drug Disorders Testing Causal Pathways. *Archives of General Psychiatry, 55*(10), 913-917.

Clark-Carter, D. (2010). *Quantitative psychological research (3rd edn) The complete student's companion.* East Sussex, UK: Psychological Press.

Clark, D.B. & Jacob, R.G. (1992). Anxiety disorders and alcoholism in adolescents: A preliminary report. *Alcoholism: Clinical and Experimental Research, 16,* p371.

Clark, W.H., Masson, C.L., Delucchi, K.L., Hall, S.M. & Sees, K.L. (2001). Violent traumatic events and drug abuse severity. *Journal of Substance Abuse Treatment, 20,* 121-127.

Cocco, K. M. & Carey, K. B. (1998). Psychometric properties of the Drug Abuse Screening Test in psychiatric outpatients. *Psychological Assessment, 10,* 408-414.

Cohen, J. (1992). A Power Primer. *Psychological Bulletin, 112*(1), 155-159.

Cooper, M.L. (1994). Motivations for alcohol use among adolescents: Development of a four-factor model. *Psychological Assessment, 6,* 117-128.

Cooper, M.L., Russell, M. & George, W.H. (1988). Coping, expectancies, and alcohol abuse: A test of social learning formulations. *Journal of Abnormal Psychology, 97,* 218-230.

Cox, M.W. & Klinger, E. (1998). A motivational model of alcohol use. *Journal of Abnormal psychology, 97*(2), 168-180.

Cox, M.W. & Klinger, E. (1990). Incentive motivation, affective change, and alcohol use: a model. In Cox, W.M. (Ed), *Why people Drink: Parameters of Alcohol as a Reinforcer.* New York: Gardener Press.

Derogatis, L.R. (1994). *Symptom Checklist-90-R (SCL-90-R): Administration, Scoring, and Procedures Manual, 3rd ed.* Minneapolis, MN: National Computer Systems.

Dixon, L.J., Leen-Feldner, E.W., Ham, L.S., Feldner, M.T. &Lewis, S.F. (2009). Alcohol use motives among traumatic event-exposed, treatment-seeking adolescents: Associations with posttraumatic stress. *Addictive Behaviours. 34,* 1065-1068.

Driessen, M., Schulte, S., Luedecke, C., Schaefer, I., Sutmann, F., Ohlmeier, M., *et al.* (2008). Trauma and PTSD in patients with alcohol, drug, or dual dependence: A Multi-Centre Study. *Alcoholism: Clinical and Experimental Research, 32,* 482-488.

El-Bassel, N., Schilling, R. F., Schinke, S., Orlandi, M., Sun, W.H., & Back, S. (1997). Assessing the utility of the Drug Abuse Screening Test in the workplace. *Research on Social Work Practice, 7,* 99-114.

Erdfelder, E., Faul, F. & Buchner, A. (1996). GPOWER: A general power analysis programme. *Behaviour Research Methods, Instruments, & Computers, 28,* 1-11.

Evren. C., Dalbudak, E., Cetin, R., Durkaya, M. & Evren, B. (2010). Relationship of alexithymia and temperament and character dimensions with lifetime post-traumatic stress disorder in male alcohol-dependent inpatients. *Psychiatry and Clinical Neurosciences, 64,* 111-119.

Field, A. (2005). *Discovering Statistics Using SPSS (2nd edn).* London: SAGE.

Ford, J.D., Chapman, J.F., Hawke, J. & Albert, D. (2007). *Trauma among youth in the juvenile justice system: critical issues and new directions.* Washington, DC: National centre for mental health and juvenile justice brief, U.S. Department of Health and Human Services.

Gavin, D.R., Ross, H.E. & Skinner, H.A. (1989). Diagnostic validity of the DAST in the assessment of DSM-III drug disorders. *British Journal of Addiction, 84,* 301-307.

Gibbs, L. E. (1983). Validity and reliability of the Michigan Alcoholism Screening Test: A review. *Drug and Alcohol Dependency, 12,* 279-285.

Grant, B.F., Stinson, F.S., Dawson, D.A., Chou, P., Dufour, M.C., Compton, W., *et al.* (2004). Prevalance and co-occurrence of substance use disorders and independent mood and anxiety disorders. *Archives of General Psychiatry, 61*(8), 807-816.

Grayson, C.E. & Nolen-Hoeksema, S (2005). Motives to drink as mediators between childhood sexual assault and alcohol problems in adult women. *Journal of Traumatic Stress, 18,* 137-145.

Green, B.L. (1996). Trauma History Questionnaire. In B. H. Stamm (Ed.), *Measurement of stress, trauma, and adaptation* (pp. 366-369). Lutherville, MD: Sidran Press.

Green, B. L., Krupnick, J.L., Rowland, J.H., Epstein, S.A., Stockton, P, Spertus, I., *et al.* (2000). Trauma history as a predictor of psychological symptoms in women with

breast cancer. *Journal of Clinical Oncology, 18*(5), 1084-1093.

Grottfredson, D. C. & Wilson, D. B. (2003). Characteristics of effective school-based substance abuse prevention. *Prevention Science, 4*, 27-38.

Hien, D.A., Jiang, H., Campbell, A.N.C., Hu, M., Miele, G.M., Cohen, L.R., *et al.* (2010). Do treatment improvements in PTSD severity affect substance outcomes? A secondary analysis from a randomised clinical trial in NIDA's clinical trials network. *American Journal of Psychiatry, 167*, 95-101.

Howard, D., Chilcoat, S.D. & Breslau, N. (1998). Post Traumatic Stress Disorders and Drug Disorders. *Archives of General Psychiatry, 55*, 913-917.

Jacobsen, L.K., Southwick, S.M. & Kosten, T.R. (2001). Substance use disorders in patients with posttraumatic stress disorder: a review of the literature. *American Journal of Psychiatry, 158*, 1184-1190.

Keane, T.M. & Kaloupek, D.G. (1998). Comorbid psychiatric disorders in PTSD: Implications for research. In Yehuda, R., & McFarlane, A.C., (Eds), *Psychobiology of posttraumatic stress disorder*. New York: New York Academy of Sciences.

Kessler, R.C., Chiu, W.T., Demler, O., Merikangas, K.R. & Walters, E.E. (2005). Prevalence, severity, and comorbidity of 12-month DSM-IV disorders in the National Comorbidity Survey Replication. *Archives of General Psychiatry, 62*(6), 617-627.

Kessler, R.C., Sonnega, A., Bromet, E., Hughes, M. & Nelson, CB. (1995). Posttraumatic stress disorder in the National Comorbidity Survey. *Archives of General Psychiatry*, 52, 1046-1060.

Khantzian, E.J. (1997). The self-medication hypothesis of substance use disorders: A reconsideration and recent applications. *Harvard Review of Psychiatry, 4*, 231-244.

Kilpatrick, D.S. & Resnick, H.S. (1992). A description of the posttraumatic stress disorder field trial. In J.R.T. Davidson & E.B. Foa (Eds). *Posttraumatic Stress Disorder: DSM-IV and Beyond* (pp 243-250). Washington, D.C: American Psychiatric Press.

Kushner, M.G., Abrams, K. & Borchardt, C. (2000). The relationship between anxiety disorders and alcohol use disorders: a review of major perspectives and findings. *Clinical Psychology Review*, *20*, 149-171.

Lecrubier Y., Sheehan, H., Weiller, E., Amorim, P., Bonora, I., Sheehan, H.K., *et al.* (1997). The Mini-International Neuropsychiatric Interview (M.I.N.I): A short diagnostic structured interview: reliability and validity according to the CIDI. *European Psychiatry, 12,* 224-231.

Maclean, M.G. & Lecci, L. (2000). A comparison of models of drinking motives in a university sample. *Psychology of Addictive Behaviours, 14*(1), 83-87.

Maisto, S. A., Carey, M.P., Carey, K.B., Gordon, C.M. & Gleason, J.R. (2000). Use of the Audit and the DAST-10 to identify alcohol and drug use disorders among adults with a severe and persistent mental illness. *Psychological Assessment, 12,* 186-192.

Maly, R. C. (1993). Early recognition of chemical dependence. *Primary Care, 20,* 33-50.

Martino, S., Grilo, C.M. & Fehon, D. C. (2000). Development of the Drug Abuse Screening Test for adolescents (DAST-A). *Addictive Behaviors, 25,* 57-70.

McCrone, P.R., Knapp, M.R.J. & Cawkill, P. (2003). Posttraumatic stress disorder (PTSD) in the armed forces: health economic considerations. *Journal of Traumatic Stress, 16, 5*19-522.

McLellan, A.T., Alterman, A.I., Cacciola, J., Metzger, D. & O'Brien, C.P. (1992). The fifth edition of the addiction severity index. *Journal of Substance Abuse Treatment, 180,* 101-110.

McLellan A.T., Luborsky, L., Cacciola, J., Griffith, J., Evans, F., Barr, H.L., *et al.* (1985). New data from the Addiction Severity Index: Reliability and validity in three centres. *Journal of Nervous and Mental Disease, 173*(7), 412-423.

Merikangas, K.R., Mehta, R.L., Molnar, B.E., Walters, E.E., Swendsen, J.D., Aguilar-Gaziola, S., *et al.* (1998). Comorbidity of substance use disorders with mood and

anxiety disorders: Results of the international consortium in psychiatric epidemiology. *Addictive Behaviours, 23*(6), 893-907.

Miller, W.R. & Marlatt, G.A. (1996). Appendix A: Relapse Interview. *Addiction, 91,* 231-240.

Mills, K.L., Teesson, M., Ross, J. & Darke, S. (2006). The impact of post-traumatic stress disorder on treatment outcomes for heroin dependence. *Addiction, 102,* 447-454.

Moher, D.A.R., Jadad, G.N., Penman, N., Tugwell, P. & Walsh, S. (1995). Assessing the Quality of Randomized Controlled Trials: An Annotated Bibliography of Scales and Checklists. *Controlled Clinical Trials, 16,* 62-73.

Najavits, L.M. (2005). Theoretical perspective on posttraumatic stress disorder and substance use disorder. *Australian Psychologist, 40,* 118-123.

Najavits, L.M. (2002). Clinicians' views on treating posttraumatic stress disorder and substance use disorder. *Journal of Substance Abuse Treatment, 22,* 79-85.

Najavits, L.M., Weiss, R.D., Shaw, S.R. & Muenz, L. (1998). "Seeking Safety": Outcome of a new cognitive-behavioural psychotherapy for women with posttraumatic stress disorder and substance dependence. *Journal of Traumatic Stress, 11,* 437-456.

Nishith, P., Resick, P.A. & Mueser, K.T. (2001). Sleep difficulties and alcohol use motives in female rape victims with posttraumatic stress disorder. *Journal of Traumatic Stress, 14*(3), 469-479.

Norman, G., (2010). Likert scales, levels of measurement, and the "laws" of statistics. *Advances in Health Sciences Education: Theory & Practice, 15*(5), 625-632.

Norman, S., Tate, S.R., Anderson, K.G. & Brown, S.A. (2007). Do trauma history and PTSD symptoms influence addiction relapse context? *Drug & Alcohol Dependence, 90*, 89-96.

Olsson, I., Mykletun, A. & Dahl, A.A. (2005). The hospital anxiety and depression rating scale: A cross-sectional study of psychometrics and case finding abilities in general practice. *BMC Psychiatry, 5*(46).

Ouimette, P., Coolhart, D., Funderburk, J.S., Wade, M. & Brown, P.J. (2007). Precipitants of first substance use in recently abstinent substance use disorder patients with PTSD. *Addictive Behaviours, 32*, 1719-1727.

Peters, R. H., Greenbaum, P.E., Steinberg, M.L., Carter, C.R., Ortiz, M.M., Fry, B.C., *et al.* (2000). Effectiveness of screening instruments in detecting substance use disorders among prisoners. *Journal of Substance Abuse Treatment, 18,* 349-358.

Petticrew, M. & Roberts, H. (2006). *Systematic Reviews in the Social Sciences: A Practical Guide*. Oxford: Blackwell.

Pinninti, N.R., Madison, H., Musser, E. & Rissmiller, D. (2003). MINI International Neuropsychiatry Schedule: Clinical utility and patient acceptance. *Journal of the Association of European Psychiatrist, 18*(7), 361-364.

Rash, C.J., Coffey, S.F., Baschnagel, J.S., Drobes, D.J. & Saladin, E. (2008). Psychometric properties of the IES-R in traumatised substance dependent individuals with and without PTSD. *Addictive Behaviours, 33*(8), 1039-1047.

Read, J.P., Brown, P.J. & Kahler, C.W. (2004). Substance use and posttraumatic stress disorders: symptom interplay and effects on outcome. *Addictive Behaviours, 29*, 1665-1672.

Reynolds, M., Mezey, G., Chapman, M., Wheeler, M., Drummond, C. & Baldacchino, A. (2004). Co-morbid post-traumatic stress disorder in a substance misusing clinical population. *Drug and Alcohol Dependence, 77*, 251-258.

Ross, H.E., Gavin, D.R. & Skinner, H.A. (1990). Diagnostic validity of the MAST and the Alcohol Dependence Scale in the assessment of DSM-III alcohol disorders. *Journal of Studies on Alcohol, 51*(6), 506-513.

Saltstone, R., Halliwell, S. & Hayslip, M.A. (1994). A multivariate evaluation of the Michigan Alcoholism Screening Test and the Drug Abuse Screening Test in a female offender population. *Addictive Behaviours, 19*(5), 455-462.

Sanderson, S., Tatt, I.D. & Higgins, J.P.T. (2007). Tools for assessing quality and susceptibility to bias in observational studies in epidemiology: a systematic review and annotated bibliography. *International Journal of Epidemiology, 36,* 666-676.

Schafer, J. & Brown, S.A. (1991). Marijuana and cocaine expectancies and drug use patterns. *Journal of Consulting and Clinical Psychology, 59,* 558-565.

Schafer, J. & Najavits, L.M. (2007). Clinical challenges in the treatment of patients with posttraumatic stress disorder and substance abuse. *Current Opinion in Psychiatry, 20,* 614-618.

Schuck, A.M. & Widom, C.S. (2001). Childhood victimisation and alcohol symptoms in females: Causal inferences and hypothesised mediators. *Child Abuse & Neglect, 25,* 1069-1092.

Selzer, M.L. (1971). The Michigan Alcoholism Screening Test: The quest for a new diagnostic instrument. *American Journal of Psychiatry, 127,* 1653-1658.

Sheehan, D.V., Lecrubier, Y., Sheehan, H., Amorim, P., Janavs, J., Weiller, E., *et al.* (1998). The Mini International Neuropsychiatric Interview (M.I.N.I): The

development and validation of a structured diagnostic psychiatric interview for DSM-IV and ICD-10. *Journal of Clinical Psychiatry, 59,* 22-33

Sheehan D.V., Lecrubier, Y., Sheehan, H.K., Janavs, J., Weiller, E., Keskiner, A., *et al.* (1997). The validity of the Mini-International Neuropsychiatric Interview (M.I.N.I) according to the SCID-P and its reliatbility. *European Psychiatry, 12*(5), 232-241.

Shora, S., Stone, E. & Fletcher, K. (2009). Substance use disorders and psychological trauma. *Psychiatric Bulletin, 33,* 257-260.

Simon, S.D. (2001). Is the randomised clinical trial the gold standard of research? *Journal of Andrology, 2,* 938-943.

Simpson, T., Jackupack, M. & Luterek, J.A. (2006). Fear and avoidance of internal experiences among patients with substance use disorders and PTSD: The centrality of anxiety sensitivity. *Journal of Traumatic Stress, 19,* 481-491.

Skinner, H.A. (1979). A multivariate evaluation of the MAST. *Journal of Studies on Alcohol, 40*(9), 831-844.

Skinner, H. A. (1982). The Drug Abuse Screening Test. *Addictive Behaviors, 7,* 363-371.

Smith, R.C., Blumenthal, H., Badour, C. & Feldner, M.T. (2010). An investigation of relations between crystal methamphetamine use and posttraumatic stress disorder. *Addictive Behaviours, 35,* 625-627.

Spencer, C., Castle, D. & Michie, P.T. (2002). Motivations that maintain substance use among individuals with psychotic disorders. *Schizophrenia Bulletin, 28*(2), 233-247.

Staley, D. & El Guebaly, N. (1990). Psychometric properties of the Drug Abuse Screening Test in a psychiatric patient population. *Addictive Behaviors, 15,* 257-264.

Stewart, S.H. & Concord, P. (2003). *Psychosocial models of functional associations between posttraumatic stress disorder and substance use disorder. Trauma and substance abuse: Causes, consequences, and treatment of comorbid disorders.* Washington, DC: American Psychological Association.

Stewart, S.H. & Devine, H. (2000). Relationships between drinking motives and drinking restraint. *Addictive Behaviours, 25,* 269-274.

Stewart, S.H., Pihl, R.O., Conrod, P.J. & Dongier, M. (1998). Functional associations among trauma, PTSD and substance-related disorders. *Addictive Behaviours, 23,* 797-812.

Stewart, S.H. (1996). Alcohol abuse in individuals exposed to trauma: A critical Review. *Psychological Bulletin, 120,* 83-112.

Tull, M.T., Gratz, K.L., Aklin, W.M. & Lejuez, C.W. (2010). A preliminary examination of the relationships between posttraumatic stress symptoms and crack/cocaine, heroin, and alcohol dependence. *Journal of Anxiety Disorders, 24,* 55-62.

Ullman, S.E., Filipas, H.H., Townsend, S.M. & Starzinski, L.L. (2005). Trauma exposure, Posttraumatic Stress Disorder and problem drinking in sexual assault survivors. *Journal of Alcohol Studies, 66,* 610-619.

Verhagen, A.P., de Vet, H.C.W., de Bie, R.A., Boers, M., & van den Brandt, P.A. (2001). The art of quality assessment of RCTs included in systematic reviews. *Journal of Clinical Epidemiology, 54,* 651-654.

Villagonzalo, K.A., Dodd, S., Ng, F., Mihaly, S., Langbein, A., & Berk, M. (2011). The relationship between substance use and posttraumatic stress disorder in a methadone maintenance treatment program. *Comprehensive Psychiatry, 52,* 562-566.

Vliet, I.M. & Beurs, E (2007). The Mini International Neuropsychiatric Interview (M.I.N.I): A brief structured diagnositic psychiatric interview for DSM-IV and ICD-10 psychiatric disorders. *Dutch Journal of Psychiatry, 6,* 393-397.

Waldrop, A.E., Santa Ana, E.J., Saladin, M.E., McRae, M.L. & Brady, K.T. (2007). Differences in early onset alcohol use and heavy drinking among persons with childhood and adulthood trauma. *American Journal on Addictions, 16,* 439-442.

Weiss, D.S. & Marmar, C.R. (1996). The Impact of Event Scale-Revised. In J. Wilson & T. M. Keane (Eds.), *Assessing psychological trauma and PTSD* (pp. 399-411). New York: Guilford.

Zigmond, A.S. & Snaith, R.P. (1983). *The Hospital Anxiety and Depression Scale.* Acta Psychiatrica Scandinavica, 67*(6), 361-370.*

Zung, B.J. (1978). Factor structure of the Michigan Alcoholism Screening Test. *Journal of Studies on Alcohol, 39*(1), 56-67.

Appendix 1: Author Guidelines, Drug and Alcohol Dependence

Guide for Authors

Drug and Alcohol Dependence is an international journal devoted to publishing original research, scholarly reviews, commentaries, and policy analyses in the area of drug, alcohol and tobacco use and dependence. It is sponsored by the College on Problems of Drug Dependence (CPDD), the oldest scientific organization in the United States concerned with research on addiction. The goal of its editors is to promote mutual understanding of the many facets of drug abuse to the benefit of all investigators involved in drug and alcohol research, and to facilitate the transfer of scientific findings to successful treatment and prevention practices. *Drug and Alcohol Dependence* is currently being distributed to all the members of CPDD.

I. Submission of Manuscripts

All submissions to Drug and Alcohol Dependence are made online. Before beginning the submission process, authors are advised to read these instructions carefully and prepare the following separate files in advance: 1) Abstract 2) Manuscript text including a title page, abstract, references and figure legends, 3) tables (if any), 4) graphics files of figures (if any), 5)author disclosure statements and 6) supplementary material for viewing with the online version of the journal (if any). Although it is possible to perform the submission in several steps, authors will find it easier to have all of the needed documents ready before they begin the process so it can be completed in one session.

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Once the uploading is done, the system automatically generates an electronic (PDF) proof, which is then used for reviewing. The submitting author will be required to view this PDF and approve it for release to the journal office. All correspondence, including the Editor's decision and request for revisions, will be processed through the system and will reach the corresponding author by e-mail. Once a manuscript has successfully been submitted, authors may track the status of their manuscript using the online submission system (details will be provided by e-mail).

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II. Preparation of manuscripts

Manuscripts should be written in English. *Drug and Alcohol Dependence* is an international journal. Authors should avoid overly parochial national or regional perspectives. Addressing a geographically, politically, and culturally diverse readership will enhance the impact of your paper.

A. Types of Papers

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2) Review Articles of specialized topics within the scope of the journal. Typically, these are critical reviews of a field of research. A Review Article typically should not exceed 6000 words for the main body of the paper (i.e., excluding references, tables and figures). Review Articles that will be substantially longer than 6000 words should be discussed with the Editor-in-Chief prior to submission.

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Smith, S.G., Davis, W.M., 1975. A method for chronic intravenous drug administration in the rat. In: Ehrenpreis, S., Neidle, A. (Eds.), Methods in Narcotics Research. Marcel Dekker, New York, pp. 3-21.

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Appendix 2: Table 2. Extraction of Relevant Information from Included Studies.

Table 2.

Study	Research Objectives	Country	Design	Sample	Variables Investigated/ Measures Used	Analysis	Key Findings
Back et al., (2000)	To compare substance use (SU) severity, trauma history, psychological symptomatology, & psychiatric comorbidity among cocaine dependent individuals with & without lifetime PTSD	USA	Observational	91 (57M: 34F)	Substance-use severity, trauma history, PTSD symptoms, Axis I & Axis II psychiatric disorders, depression, mania, global measure of psychological distress. <u>Measures:</u> - SCID-R - ASI - CEQ - QCH - TLFB - NWS - DIS - BDI - HamD - Young Mania Scale - SCL-90-R	T-Tests ANOVA Chi-square	Individuals with PTSD (compared to those without PTSD) had: - Significantly higher trauma exposure - Earlier age of first assault - More severe symptomatology - Higher rates of Axis I & Axis II diagnoses
Back et al., (2005)	To examine order of onset differences in clinical presentation & in response to CBT (for	USA	RCT	86 (45M:41F) (Participants were drawn	Substance-use severity, trauma history, PTSD symptoms,	ANOVA (post hoc)	- PTSD most often preceded alcohol dependence - Females with primary AD & males with

	alcohol use) in individuals with alcohol dependence (AD) & PTSD			from a parent study which involved 12 weeks of psychotherapy & pharmaco-therapy)	depression, order of onset, response to treatment. <u>Measures:</u> - SCID - ASI - TLFB - NWS - CAPS - MISS - IES - HamD		primary PTSD presented as more distressed and/or depressed than counterparts at baseline - Observed relationship between increased alcohol intake & higher PTSD symptoms - Primary PTSD group derived greater benefit from CBT than primary AD group.
Back et al., (2006)	To investigate the temporal course of improvement in PTSD & alcohol dependence symptoms among participants participating in a 12-week outpatient treatment study	USA	Observational	94 (51M:43F) (Participants drawn from a parent RCT investigating use of sertraline in the treatment of comorbid PTSD & AD)	PTSD symptom severity & alcohol use severity. <u>Measures:</u> - SCID - ASI - TLFB - CAPS - IES - MISS	ANOVA Chi-squares Bivariate & partial Pearson's correlations	- Alcohol symptoms tended to start improving either before or in conjunction with PTSD symptoms - Improvements in PTSD symptoms had a greater impact on improvement in AD symptoms (compared to the reciprocal relationship) - Improvements in hyperarousal PTSD symptoms, in particular, were related to substantially improved alcohol use.

Bornovalova et al., (2009)	To examine gender differences in mechanisms that may explain the association between PTSD & SUD	USA	Observational	182 (132M:50F)	PTSD symptom severity, substance use frequency, lack of emotional awareness & clarity of emotions & difficulty controlling impulsive behaviours when distressed. <u>Measures:</u> - PCL - DERS	Descriptive Structural equation modelling Correlations	- PTSD symptoms were associated with a lack of clarity & awareness of emotions as well as difficulty controlling impulsive behaviours when distressed - For females, the association between PTSD symptoms & substance use frequency was partially accounted for by difficulties controlling impulsive behaviour when distressed - For males, the relationship between PTSD symptoms & substance use frequency was partially explained by lack of emotional awareness & clarity of emotions.
Clark et al., (2001)	To investigate the extent to which violent traumatic events, PTSD, & recency of PTSD-related symptoms contribute to drug use severity in methadone treatment patients.	USA	Observational	150(91M:59M) (Participants drawn from a parent RCT comparing methadone detoxification plus an intensive psychosocial treatment versus methadone maintenance with a standard psychosocial treatment)	PTSD & PTSD status, substance use severity, depression symptoms & dysthymia. <u>Measures:</u> - CDIS - BDI - ASI	ANOVA t-tests Chi-squares Logistic regression Hierarchical multiple regression	- 29% of participants were classified as having had a diagnosis of PTSD at some point in their life - 55% of those with a history PTSD reported PTSD symptoms in the past six months - Those meeting the criteria for PTSD reported: a greater total number of traumatic events & were more likely to be diagnosed with depression & dysthymia than those who did not meet diagnostic criteria - The occurrence of PTSD-related symptoms was associated with greater drug abuse severity after controlling for gender, depression, & lifetime diagnosis of PTSD

Driessen et al., (2008)	To investigate the association between PTSD & the severity & course of addiction & psychopathology in patients with PTSD, subsyndromal PTSD & in those with a history of trauma exposure without PTSD	Germany	Observational	459 (183F:276M)	PTSD, subsyndromal, PTSD, trauma exposure, substance use severity, general psychopathology <u>Measures:</u> - IDCL - PDS - ASI - BPRS - SAM	Chi-squares ANOVA ANCOVA General linear models	- Prevalence of PTSD was higher in drug & combined alcohol & drug dependence than in alcohol dependence - The more strictly PTSD was diagnosed the clearer the associations with social status, addiction, & psychopathology - PTSD was an independent risk factor for an unfavourable course & outcome of SUD - Subsyndromal PTSD was associated with a higher degree of psychopathology but the effects were limited
Evren et al., (2010)	To evaluate the prevalence of lifetime PTSD in male alcohol-dependent inpatients & to investigate the relationship of PTSD with alexithymia & temperament & character dimensions.	Istanbul	Observational	156 M	PTSD, PTSD symptom severity, alexithymia, temperament & character traits. <u>Measures:</u> - SCID - CAPS - TAS-20 (Turkish Version) - TCI (Turkish Version)	Chi-squares t-tests logistic regression	- 32.1% of participants had lifetime PTSD. - Individuals with PTSD had higher scores of alexithymia, novelty seeking, harm avoidance and self-transcendence. - 'Difficulty in identifying feelings' predicted PTSD.

Hien et al., (2010)	To examine the temporal course of improvement in symptoms of PTSD and SUD among woman in outpatient substance abuse treatment.	USA	RCT	353F	PTSD symptom severity, substance use severity, PTSD & SUD symptom severity improvement. <u>Measures:</u> - CAPS - ASI	Continuous Markov model Generalised liner model	- PTSD severity reductions were associated with substance use improvement. - There was minimal evidence that substance use reduction improved PTSD symptoms.
Mills et al., (2006)	To examine the impact of PTSD on 2-year treatment outcomes for heroin dependence.	Australia	Observational	615 (209F: 406M)	Treatment retention, substance use, general physical & mental health, employment. <u>Measures:</u> - CIDI - OPTI - SF-12 - DIS - IPDEQ	t-tests Mann-Whitney U-tests Chi-squares Logistic regression Generalised estimating equations	- Despite improvements in substance use, PTSD was associated with continued impairment in occupational, physical & psychosocial functioning throughout the 2-year follow-up. - At 2-year follow-up, both those with & without current PTSD were equally as likely to be retained in their index maintenance therapy.

Norman et al., (2007)	To compare SUD treatment outcomes & relapse features in male veterans who had, no history of trauma exposure, PTSD, & a history of trauma exposure but no PTSD.	USA	Observational	134 M	Psychiatric symptoms, SU severity, post treatment substance use (abstinence, relapse & severity), contextual features of relapse. <u>Measures:</u> - SSAGA - BSI - TLFB - CCAI (modified version)	Logistic regression ANOVAs Chi-squares	- The groups did not differ on length of abstinence, relapse prevalence or severity. - SUD-PTSD and SUD-trauma groups reported more depression, anxiety, PTSD and total psychiatric symptoms prior to & following relapse than the SUD-only group. - PTSD symptoms were associated with greater risk of relapse in interpersonal & negative psychological contexts.
Ouimette et al., (2007)	To examine precipitants & characteristics associated with relapse in those with and without PTSD.	USA	Observational	65 (57F: 8M)	Base-line & follow up PTSD, precipitants of relapse. <u>Measures:</u> - CAPS - RI - SCID - TLFB	Descriptive Fisher's Exact test Odds ratio t-tests	-T hose with PTSD were less likely to report first substance use triggered by cue-based urges & more likely to report use in response to negative emotions of an interpersonal nature than those without PTSD - Greater subjective urges right before using, greater efforts to obtain substances & more likelihood to use to intoxification were associated with PTSD - Those with unremitted PTSD at follow-up reported poorer outcome & self-efficacy expectations than those without PTSD or with remitted PTSD.

Read et al., (2004)	To examine the concurrent & prospective associations between SUD & PTSD & the symptoms & mechanisms underlying these associations.	USA	Observational	133 (68F:65M)	Traumatic exposure, PTSD symptom severity, percent days abstinent, SUD, mood and anxiety disorders, general psychiatric distress. <u>Measures:</u> - LSC-R - CAPS - SCID - TLFB - SCL-90-R	Descriptive Chi-squares T-tests Hierarchical multiple regression	- Baseline PTSD status did not predict substance use outcome. - Change in PTSD status over follow-up predicted substance use outcomes; those with unremitted PTSD (present at baseline & follow-up) demonstrated poorer SUD outcome than those with remitted PTSD. - General psychiatric distress at follow-up was associated with poorer outcomes, and such distress mediated the association between PTSD change status and substance use outcome.
Reynolds et al., (2004)	To investigate the prevalence of co-morbid PTSD & SUD in a inpatient population; to identify the characteristics, severity & types of trauma experiences; to compare substance use history, psychological/psychiatric & social variables in those with and without PTSD.	UK	Observational	52 (31M:21F)	Trauma exposure history, traumatic memory and trauma characteristics, PTSD symptom severity, substance use severity, co-morbid disorders, social functioning.	Descriptive Chi-squares Fisher's test ANOVA	- 38.5% met criteria for current PTSD - 51.9% met criteria for lifetime PTSD - PTSD was significantly associated with more lifetime & psychiatric problems - There was a trend for those with PTSD to have higher substance use severity scores than those without PTSD - Those with PTSD reported: Greater impairment in their social, occupational and family responsibilities & more distress associated with their target trauma & with memories of the target trauma compared to those without PTSD. - There were minimal differences with psychiatric symptomatology between those with & without PTSD

					Measures: - ASI - THQ - PSS-I - BSI - TMTC		
Simpson et al., (2006)	To evaluate anxiety sensitivity, cognitive avoidance, & alexithymia & their relationship to PTSD & alcohol use concurrently and prospectively.	USA	Observational	77 (69M:8F)	PTSD symptom severity, anxiety sensitivity, cognitive strategies, difficulty in identifying feelings, alcohol craving, alcohol use. Measures: - PCL-C - ANSI - WBSI - TCQ - TAS-20 - PACS - TLFB - AUDIT	T-Tests Pearson's correlations Regression	- Anxiety sensitivity accounted for a significant amount of variance in PTSD symptom cluster severity - Cognitive avoidance accounted for additional variance with concurrent PTSD avoidance symptoms - Anxiety sensitivity & cognitive avoidance were not associated with alcohol use indices - Alexithymia was redundant with cognitive avoidance and was not included in the regression analyses

Smith et al., (2010)	To investigate the relationship between PTSD & lifetime histories of crystal methamphetamine (CM) use.	USA	Observational	89(66F: 23 M)	Trauma exposure, PTSD symptom severity, CM use duration. <u>Measures:</u> - CAPS - PDS	Descriptive Chi-squares t-tests ANCOVA Logistic regression	- Individuals with PTSD were significantly more likely to report CM use than trauma-exposed individuals without PTSD - CM users with PTSD reported a longer duration of CM use than trauma-exposed CM users without PTSD - PTSD avoidance & hyperarousal symptoms were related to CM use.
Tull et al., (2010)	To examine the relationship between severity of Post Traumatic Stress (PTS) symptom clusters and heroin, crack/cocaine, and alcohol dependence.	USA	Observational	48 (39M: 9F)	Traumatic events, heroin, crack/cocaine and alcohol dependence. PTSD symptom severity, depression severity. <u>Measures:</u> - MINI - TEQ - PCL - CES-D	Descriptive Hierarchical logistic regression	- Hyperarousal & avoidance symptoms were associated with heroin dependence. - There was no evidence found for a relationship between PTS symptom clusters & crack/cocaine or alcohol dependence.

Villagonzalo et al., (2011)	To explore the relationship between substance abuse and PTSD symptom clusters in a methadone maintenance population.	Australia	Observational	80 (37M:43F)	PTSD symptom severity & substance use severity. <u>Measures:</u> - PCL-C - SU	ANOVA t-tests Spearman's correlations Chi-squares	- PTSD symptom severity was strongly linked with severity of marijuana use - Severity of opiate, amphetamine, and benzodiazepine use was not associated with PTSD symptoms
Waldrop et al., (2007)	To compare high-risk triggers and substance use situations among individuals with AD or cocaine dependence (CD), with or without comorbid PTSD.	USA	Observational	72 (34M:38F)	PTSD, SUD, high-risk triggers & situations. <u>Measures:</u> - SCID - IDTS	Descriptive ANCOVA	- Individuals with PTSD compared to those without PTSD reported greater use of substances in response to negative situations - CD individuals with PTSD reported greater use of cocaine during pleasant times with others compared to those without PTSD

(SCID-R = The Structured Clinical Interview for the DSM-III-R, ASI = The Addiction Severity Index, CEQ = Cocaine Experience Questionnaire, QCH = Quantitative Cocaine History, TLFB = Time-Line Follow-Back, NWS = The National Women's Study, DIS = Diagnostic Interview Schedule, BDI = Beck Depression Inventory, HamD = Hamilton Depression Scale, SCL-90-R = The Symptom Checklist 90, Revised, SCID = The Structured Clinical Interview for the DSM-IV, CAPS = Clinical Administered PTSD Scale, MISS = The Civilian Mississippi Scale for PTSD, IES = Impact of Events Scale, PCL = Posttraumatic Stress Disorder Checklist – Civilian Version, DERS = Difficulties in Emotion Regulation Scale, CDIS = Computerised Diagnostic Interview Schedule, IDCL = The International Diagnostic Checklists, PDS = The Posttraumatic Diagnostic Scale, BPRS = Brief Psychiatric Rating Scale, SAM = The Self-assessment manikin, TAS-20 = Toronto Alexithymia Scale, TCI = Temperament Character Inventory, CIDI = Composite International Diagnostic Interview, OPTI = Opiate Treatment Index, SF-12 = Short Form – 12, IPDEQ = International Personality Disorders Examination Questionnaire, SSAGA = Semi Structured Assessment for the Genetics of Alcoholism, lifetime version, BSI = Brief Symptom Inventory, CCAI = Contextual Cue Assessment Interview, RI = Relapse Interview, LSC-R = The Life Stressor Checklist-Revised, THQ = The Trauma History Questionnaire, PSS-1 = Posttraumatic Stress Symptom Scale – Interview version, TMTC = Traumatic Memory and Trauma Characteristics, PCL-C = PTSD Checklist – Civilian Version, ANSI = The Anxiety Sensitivity Index, WBSI = The White Bear Suppression Inventory, TCQ = Thought Control Questionnaire, PACS = The Penn Alcohol Craving Scale, AUDIT = The Alcohol Use Disorders Identification Test, MINI = The Mini International Neuropsychiatric Interview, TEQ = Traumatic Events Questionnaire, CES-D = Centre for Epidemiological Studies – Depression Scale, SU = Substance Use Questionnaire, IDTS = The Inventory of Drug Taking Situations).

Appendix 3: Table 3. Summary of methodological quality of included studies.

	1.Clear question	2.Reliability of diagnosis	3.Variables examined	4. How variables assessed	5.Charact-eristics of sample	6.Inclusion & exclusion criteria	7. Method of selection	8. Power calculation	9.Statistic al analyses	10. Findings	Quality 'score' (/20)
Study											
Back et al., (2000)	1	2	2	2	2	2	1	0	2	2	16
Back et al., (2005)	1	2	2	2	1	2	1	0	1	1	13
Back et al., (2006)	1	2	2	1	1	2	1	0	2	1	13
Bornovalova et al., (2009)	2	1	1	1	2	0	1	0	2	1	11
Clark et al., (2001)	1	2	1	2	2	2	1	0	1	2	14
Driessen et al., (2008)	2	2	2	2	2	2	2	0	1	2	17
Evren et al., (2010)	1	2	1	2	2	1	1	0	2	1	13
Hien et al, (2010)	1	2	2	2	2	2	2	0	2	2	17
Mills et al., (2006)	1	1	1	1	2	0	2	0	2	2	12
Norman et al., (2007)	2	1	1	1	2	1	1	0	1	2	12
Ouimette et al., (2007)	1	1	1	1	2	0	1	0	1	1	9
Read et al, (2004)	1	1	1	1	0	0	0	0	1	1	6
Reynolds et al., (2004)	2	1	1	2	2	2	1	2	2	1	16
Simpson et al., (2006)	2	1	2	1	2	0	1	0	1	2	12
Smith et al., (2010)	2	1	1	2	1	1	1	0	2	1	12
Tull et al., (2010)	2	2	2	1	1	1	1	0	1	2	13
Villagonzalo et al., (2011)	2	1	1	1	2	0	1	0	2	2	12
Waldrop et al., (2007)	1	1	1	1	1	0	1	0	0	1	7

Appendix 4: Favourable ethical opinion

Appendix 5: NHS Fife Management Approval

Appendix 6: Copy of all measures used in the empirical study